Service Manual Outline

Section 1 - General Information & Specifications
- A - Specifications
- B - Maintenance
- C - General Information
- D - Outboard Installation

Section 2 - Electrical and Ignition
- A - Ignition System
- B - Charging & Starting System
- C - Timing/Synchronizing & Adjusting
- D - Wiring Diagrams

Section 3 - Fuel System
- A - Fuel Delivery System
- B - Emissions

Section 4 - Powerhead

Section 5 - Mid-Section
- A - Clamp/Swivel Brackets and Driveshaft Housing
- B - Power Trim

Section 6 - Lower Unit

Section 7 - Attachments/Control Linkage
- A - Throttle/Shift Linkage (Tiller Handle Shift Models)
- B - Throttle/Shift Linkage (Side Shift Models)
- C - Tiller Handle

Section 8 - Manual Starter

Notice

Throughout this publication, **Dangers**, **Warnings** and **Cautions** (accompanied by the International HAZARD Symbol ⚠) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY!**

These Safety Alerts alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus Common Sense operation, are major accident prevention measures.

⚠ DANGER

DANGER - Immediate hazards which WILL result in severe personal injury or death.

⚠ WARNING

WARNING - Hazards or unsafe practices which COULD result in severe personal injury or death.

⚠ CAUTION

Hazards or unsafe practices which could result in minor personal injury or product or property damage.

Notice to Users of This Manual

This service manual has been written and published by the Service Department of Mercury Marine to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures of these products, or like or similar products manufactured and marketed by Mercury Marine, that they have been trained in the recommended servicing procedures of these products which includes the use of mechanics' common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. As required, revisions to this manual will be sent to all dealers contracted by us to sell and/or service these products.

It should be kept in mind, while working on the product, that the electrical system and ignition system are capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.

It is important to note, during any maintenance procedure replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the metric bolts and on the surfaces of metric nuts indicate their strength. American bolts use radial lines for this purpose, while most American nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possibly personal injury. Therefore, fasteners removed should be saved for reuse in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.

Cleanliness and Care of Outboard Motor

A marine power product is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten thousands of an inch/mm. When any product component is serviced, care and cleanliness are important. Throughout this manual, it should be understood that proper cleaning, and protection of machined surfaces and friction areas is a part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever components are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.

Personnel should not work on or under an outboard which is suspended. Outboards should be attached to work stands, or lowered to ground as soon as possible.

We reserve the right to make changes to this manual without prior notification.

Refer to dealer service bulletins for other pertinent information concerning the products described in this manual.

Propeller Information

For in-depth information on marine propellers and boat performance – written by marine engineers – see your Authorized Dealer for the illustrated "**What You Should Know About Quicksilver Propellers... and Boat Performance Information**" (Part No. 90-86144 92).

How To Use This Manual

The manual is divided into SECTIONS which represents major components and systems.

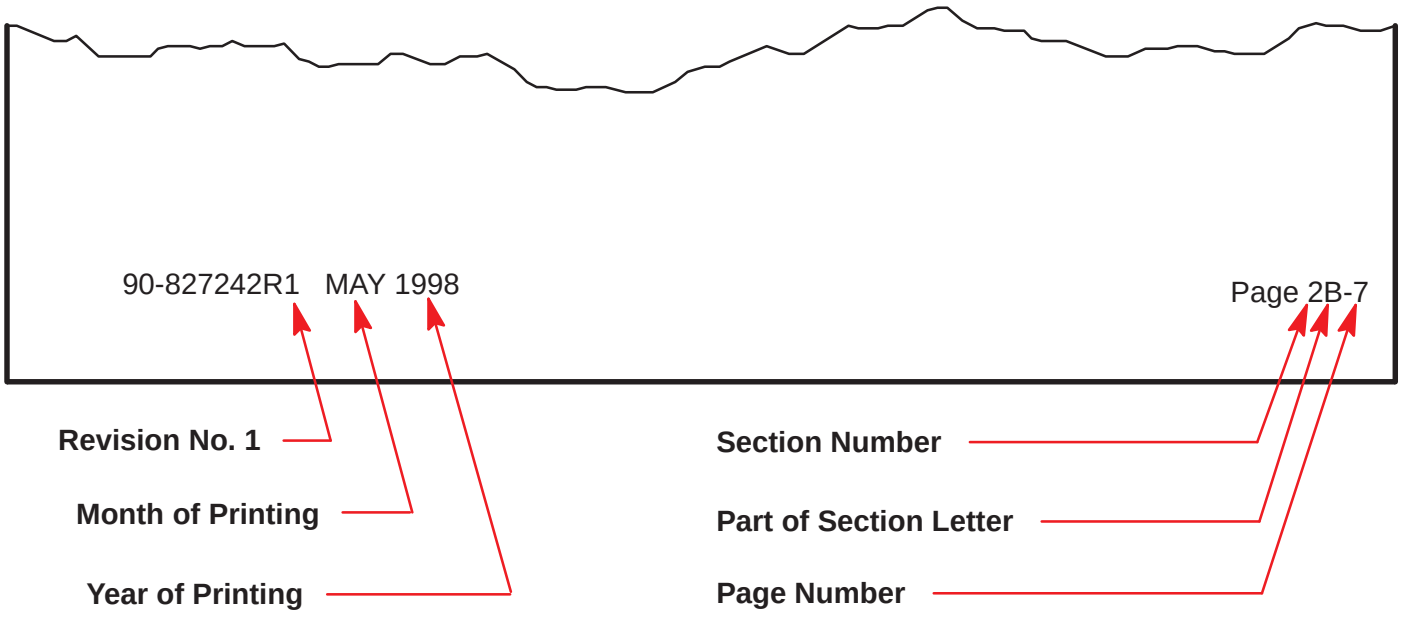
Some SECTIONS are further divided into PARTS. Each PART has a title page. A **Table of Contents** for the particular PART is printed on the back of the title page.

SECTIONS and PARTS are listed on the **Service Manual Outline** sheet which immediately follows the cover of this book.

Page Numbering

Two number groups appear at the bottom of each page. The example, below, is self-explanatory.

EXAMPLE:



GENERAL INFORMATION & SPECIFICATIONS

1 A

Section 1A – Specifications

Table of Contents

General Specifications 1A-1
Propeller Information Chart - 6 HP 1A-6
Propeller Information Chart - 8 HP 1A-6
Propeller Information Chart -9.9/10 HP 1A-7
Propeller Information Chart -15 HP 1A-7
Mercury/Quicksilver Lubricants and Sealants 1A-8

General Specifications

Models 6/8/9.9/10/15		
PERFORMANCE KW (HP)	**Model 6**	4.5 (6)
	Model 8	5.9 (8)
	Model 8 Sailmate	5.9 (8)
	Model 9.9	7.4 (9.9)
	Model 9.9 Sailpower	7.4 (9.9)
	XR/MAG/Viking10	7.5 (10)
	Model Sea Pro/Marathon 10	7.5 (10)
	Model 15	11.2 (15)
	Model Sea Pro/Marathon 15	11.2 (15)
OUTBOARD WEIGHT	**Manual Start**	
	6	33.1 kg (73.0 lb)
	8	33.1 kg (73.0 lb)
	8 Sailmate	33.8 kg (74.5 lb)
	9.9	33.8 kg (74.5 lb)
	9.9 Sailpower	34.2 kg (76.5 lb)
	XR/MAG/Viking10	33.8 kg (74.5 lb)
	Sea Pro/Marathon 10	33.8 kg (74.5 lb)
	15	34.0 kg (75.0 lb)
	Sea Pro/Marathon 15	34.0 kg (75.0 lb)
	Electric Start	
	6	36.1 kg (79.5 lb)
	8	36.1 kg (79.5 lb)
	9.9	36.7 kg (81.0 lb)
	9.9 Sailpower	37.7 kg (83.0 lb)
	15	37.0 kg (81.5 lb)
FUEL SYSTEM	**Recommended Gasoline**	Automotive Unleaded with a Minimum Pump Posted Octane Rating of 86
	Recommended Oil	2 Cycle Outboard Oil
	Ratio	25:1 (During break-in) 50:1 (After break-in)
	Fuel Tank Capacity	
	6/8/9.9/Sailpower, XR/MAG10	12.0 L, 2.7 Imp Gal., 3.2 U.S. Gal.
	10 Sea Pro Marathon/15	25.0 L, 5.5 Imp Gal., 6.6 U.S. Gal.

CYLINDER BLOCK	**Type**	Two-Stoke Cycle – Cross Flow
	Displacement (1994 Model)	
	6	209 cc (12.8 cu. in.)
	8	209 cc (12.8 cu. in.)
	9.9	209 cc (12.8 cu. in.)
	9.9 Sailpower	209 cc (12.8 cu. in.)
	10 Sea Pro/Marathon	262 cc (16.0 cu. in.)
	XR10/MAG10	262 cc (16.0 cu. in.)
	15	262 cc (16.0 cu. in.)
	Displacement (1995 and Newer)	
	9.9	262 cc (16.0 cu. in.)
	9.9 Sailpower	262 cc (16.0 cu. in.)
	10 Sea Pro/Marathon	262 cc (16.0 cu. in.
	XR/MAG/Viking 10	262 cc (16.0 cu. in.)
	15	262 cc (16.0 cu. in.)
	15 Sea Pro/Marathon	262 cc (16.0 cu. in.)
CYLINDER BORE	**Diameter (Standard)(1994 Model)**	
	6	53.975 mm (2.125 in.)
	8	53.975 mm (2.125 in.)
	8 Sailmate	53.975 mm (2.125 in.)
	9.9	53.975 mm (2.125 in.)
	9.9 Sailpower	53.975 mm (2.125 in.)
	10 Sea Pro/Marathon	60.325 mm (2.375 in.)
	XR/Mag 10	60.325 mm (2.375 in.)
	15	60.325 mm (2.375 in.)
	Diameter (Standard)(1995 Model)	
	9.9	60.325 mm (2.375 in.)
	9.9 Sailpower	60.325 mm (2.375 in.)
	10 Sea Pro/Marathon	60.325 mm (2.375 in.)
	XR/Mag/Viking 10	60.325 mm (2.375 in.)
	15	60.325 mm (2.375 in.)
	15 Sea Pro/Marathon	60.325 mm (2.375 in.)
	Taper/Out of Round Maximum	0.1016 mm (0.004 in.)
	Bore Type	Cast Iron
STROKE	**Length**	45.7 mm (1.800 in.)
CRANKSHAFT	**Top Main Bearing Journal**	19.1 mm (0.7517 in.)
	Center Main Bearing Journal	20.6 mm (0.8108 in.)
	Bottom Ball Bearing Journal	20.0 mm (0.7880 in.)
	Connecting Rod Journal	20.6 mm (0.8125 in.)
	Runout	0.076 mm (0.003 in.)
CONNECTING ROD	**Piston Pin End (I.D.)**	20.8 mm (0.8195 in.)
	Crankpin End (I.D.)	27.0 mm (1.0635 in.)
PISTON	**Piston Type**	Aluminum
	Ring End Gap	0.25 mm - 0.46 mm (0.010 in. - 0.018 in.)
REEDS	**Reed Stand Open (Maximum)**	
	All Models	0.178 mm (0.007 in.)
	Reed Stop Opening (Maximum)	
	All Models	7.54 mm (0.296 in.)

GEAR HOUSING	**Gear Ratio**	2.0:1
	Gearcase Capacity	200 ml (6.8 fl. oz.)
	Lubricant Type	Quicksilver Gear Lube Premium Blend
	Forward Gear - Tooth count - Type	26 Spiral/Bevel
	Pinion Gear - Tooth count - Type	13 Spiral/Bevel
	Pinion Height	Floating
	Forward Gear Backlash	No Adjustment
	Reverse Gear Backlash	No Adjustment
	Water Pressure	
	With Thermostat	
	– @ W.O.T (5000 RPM)	34.5 - 48.3 kPa (5 - 7 PSI)
	– @ Idle (750 RPM)	3.4 - 10.3 kPa (.5 – 1.5 PSI)
	W/O Thermostat	
	– @ W.O.T (5000 RPM)	34.5 - 48.3 kPa (5 – 7 PSI)
	– @ Idle (750 RPM)	0 - 7 kPa (0 – 1 PSI)
MID SECTION	**Transom Height Short Shaft**	38 cm (15 in.)
	Long Shaft	51 cm (20 in.)
	Extra Long Shaft	63.5 cm (25 in.)
	Steering Pivot Range	78°
	Tilt Pin Positions	3 + 3 Shallow Water
	Total Tilt Angle	78°
	Allowable Transom Thickness	60.3 mm (2-3/8 in.)
FUEL SYSTEM	**Fuel**	Pre-Mixed Gasoline and Oil
	Recommended Gasoline	Automotive Lead-Free
	Recommended Oil	2 Cycle Outboard Oil
	Gasoline/Oil Ratio	25:1 (During Break-In) 50:1 (After Break-In)
	Fuel Tank Capacity	
	6/8/9.9/9.9 Sailpower	12.0 L, 3.2 U.S. Gal.
	XR/MAG/10 Sea Pro/ Marathon/15	25.0 L, 6.6 U.S. Gal.
STARTING SYSTEM	**Manual Start**	Recoil
	Electric Start	12 Volt
	Starter Draw (Under Load)	55 Amperes
	(No Load)	15 Amperes
CHARGING SYSTEM	**Alternator Output**	
	BLACK Stator - 2 Magnet Flywheel (8 Pole)(4 Pulses)	4 Amp. (48 Watt) @ 6000 RPM
	RED Stator - 4 Magnet Flywheel (10 Pole)(5 Pulses)	6 amp (72 Watt) @ 6000 RPM

BATTERY	**Battery Rating**	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)
IGNITION SYSTEM	**Type**	Capacitor Discharge
	SPARK PLUG (1994)	
	6/8/9.9	NGK BP8H-N-10
	10/15	NGK BP8HS-15 NGK BPZ8H-N-10*
	SPARK PLUG GAP (1994)	
	6/8/9.9	1.0 mm (0.040 in.)
	10/15	1.5 mm (0.060 in.)
	SPARK PLUG (1995 AND NEWER)	
	6/8	NGK BP8H-N-10
	9.9/10/15	NGK BP8HS-15 NGK BPZ8H-N-10*
	SPARK PLUG GAP (1995 AND NEWER)	
	6/8	1.0 mm (0.040 in.)
	9.9/10/15	1.5 mm (0.060 in.)
	Firing Order	1-2
	Stator High Speed Winding	120 - 180 Ω (BLACK/WHITE - GROUND)
	Stator Low Speed Winding	3200 - 3800 Ω (BLACK/YELLOW - GROUND)
	Diode Test	3100 – 3700 Ω (BLACK/YELLOW - BLACK/WHITE)
	Ignition Coil Resistance:	
	Primary	0.02 - 0.04 Ω
	Secondary	8000 - 11000 Ω
	Trigger	6500 - 8500 Ω

NOTE: **Use NGK-BPZ8H-N-10 where radio frequency interference (RFI) suppression is required.*

CARBURETOR SPECIFICATIONS	**Type**	Center Bowl, Integral Fuel Pump
	Idle RPM (In Gear)	
	6	650 ± 75
	8	725 ± 50
	9.9/9.9 Sailpower	725 ± 50
	10 Sea Pro/Marathon	850 ± 50
	XR/MAG/Viking 10	725 ± 50
	15	725 ± 50
	Wide Open Throttle RPM	
	6	4000 – 5000
	8	4500 – 5500
	9.9/9.9 Sailpower	5000 – 6000
	10 Sea Pro/Marathon	5000 – 6000
	XR/MAG/Viking 10	5000 – 6000
	15	5000 – 6000
	15 Sea Pro/Marathon	5000 – 6000
	Idle Mixture Screw (Initial Setting)	Refer to Section 3 for Specifics
	Float Setting (All Models)	25.4 mm (1 in.)
	Main Jet –	
	Thread size	10–32
		1994 Model Year
	6	.042
	8	.046
	9.9/9.9 Sailpower	.052
	10 Sea Pro/Marathon	.064
	XR/MAG 10	.052
	15	.066
		1995 and Newer
	6	.042
	8	.046
	9.9/9.9 Sailpower	.048
	10 Sea Pro/Marathon	.052
	XR/MAG 10	.052
	15/Viking 10	.072
	15 Sea Pro/Marathon	.072
TIMING SPECIFICATIONS	**Idle**	
	6	8° BTDC ± 1°
	8/8 Sailmate	8° BTDC ± 1°
	9.9/9.9 Sailpower	8° BTDC ± 1°
	10 Sea Pro/Marathon	8° BTDC ± 1°
	XR/MAG/Viking 10	8° BTDC ± 1°
	15	8° BTDC ± 1°
	15 Sea Pro/Marathon	8° BTDC ± 1°
	Maximum BTDC @ 4500 RPM – All Models	36° BTDC

Propeller Information Chart - 6 HP

Wide Open Throttle RPM: 4000-5000
Recommended Transom Height: 15″, 20″, 25″
Right Hand Rotation Standard
Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9″	9″	3	Alum.	Up To 1400	Up To 15′	10-19	48-828156A12
9″	8″	3	Alum.	1000 – 2200	12′ - 16′	8-15	48-828154A12
9-1/4″	7″	3	Alum.	1200 – 2600	13′ - 17′	5-12	48-828152A12
9-3/4″	6-1/2″	3	Alum.	1500+	High Reverse Thrust	3-10	48-828150A12
9-3/4″	5-1/2″	3	Alum.	1900+	Workboat	1-8	48-828148A12

Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)

Propeller Information Chart - 8 HP

Wide Open Throttle RPM: 4500-5500
Recommended Transom Height: 15″, 20″, 25″
Right Hand Rotation Standard
Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9″	9″	3	Alum.	Up To 1200	Up To 16′	12-22	48-82815612
9″	8″	3	Alum.	1100 – 2000	14′ - 17′	10-20	48-828154A12
9-1/4″	7″	3	Alum.	900 – 2400	14′ - 18′	7-15	48-828152A12
9-3/4″	6-1/2″	3	Alum.	1400+	High Reverse Thrust	4-12	48-828150A12
9-3/4″	5-1/2″	3	Alum.	1700+	Workboat	1-10	48-828148A12

Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)

Propeller Information Chart -9.9/10 HP

Wide Open Throttle RPM: 5000-6000
Recommended Transom Height: 15″, 20″, 25″
Right Hand Rotation Standard
Gear Reduction: 2:1

Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9″	9″	3	Alum.	Up To 1200	Up To 16′	12-24	48-828156A12
9″	8″	3	Alum.	1100 – 2000	14′ - 17′	12-22	48-828154A12
9-1/4″	7″	3	Alum.	900 – 2400	14′ - 18′	8-18	48-828152A12
9-3/4″	6-1/2″	3	Alum.	1400+	High Reverse Thrust	5-15	48-828150A12
9-3/4″	5-1/2″	3	Alum.	1700+	Workboat	1-13	48-828148A12

Thrust Hub: 42630 1 (Forward)

Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)

Propeller Information Chart -15 HP

Wide Open Throttle RPM: 5000-6000
Recommended Transom Height: 15″, 20″, 25″
Right Hand Rotation Standard
Gear Reduction: 2:1

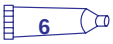
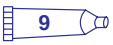
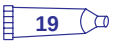
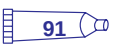
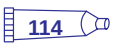
Diameter	Pitch	No. Of Blades	Material	Typical Gross Boat WGT. (LBS)	Typical Boat Length	Speed Range (MPH)	Propeller Part Number
9″	10-1/2″	3	Alum.	Up To 1000	Up To 16′	18-28	48-828158A12
9″	9″	3	Alum.	600 – 1500	14′ - 18′	14-24	48-828156A12
9″	8″	3	Alum.	800 – 2400	15′ - 20′	15-25	48-828154A12
9-1/4″	7″	3	Alum.	1000 – 3400	16′ - 22′	8-18	48-828152A12
9-3/4″	6-1/2″	3	Alum.	1800+	High Reverse Thrust	1-15	48-828150A12

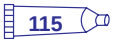
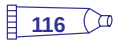
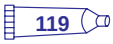
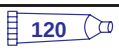
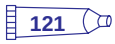
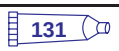
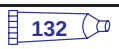
Thrust Hub: 42630 1 (Forward)

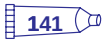
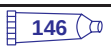
Propeller Drive Hub: 827598T

Diffuser Ring: 42594 (Aluminum)

Mercury/Quicksilver Lubricants and Sealants

Tube Ref. No.	Description	Mercury Part Number	Quicksilver Part Number
	Needle Bearing Assembly Lubricant	92-802868A1	N/A
	Dielectric Grease	92-823506-1	92-823506-1
	Loctite 271 – Thread Locker	92-809819	92-809819
	Loctite 567 PST Pipe Sealant	92-809822	92-809822
	Loctite Master Gasket Kit	92-12564-2	92-12564-2
	2 Cycle Premium Outboard Oil	92-802813A1	92-802813Q1
	Perfect Seal	92-34227-1	92-34227-1
	Liquid Neoprene	92-25711-3	92-25711-3
	Bellows Adhesive	N/A	92-86166Q1
	Loctite 680 Retaining Compound	92-809833	92-809833
	Special Lubricant 101	92-802865A1	92-802865Q1
	U-Joint and Gimbal Bearing Grease	92-802870A1	92-802870Q1
	Loctite 222 Thread Locker	92-809818	92-809818
	Loctite 242 Thread Locker	92-809821	92-809821
	4 Cycle 25W40 Engine Oil	92-802837A1	92-802837Q1
	Premium Gear Lubricant	92-802846A1	92-802846Q1
	High Performance Gear Lube	92-802854A1	92-802854Q1
	Engine Coupler Spline Grease	92-802869A1	92-802869Q1
	Anti-Corrosion Grease	92-802867A1	92-802867Q1
	2-4-C with Teflon	92-802859A1	92-802859Q1
	4 Stroke 10W30 Outboard Oil	92-802833A1	92-802833Q1
	Power Trim & Steering Fluid	92-802880A1	92-802880Q1

Tube Ref. #	Description	Mercury Part Number	Quicksilver Part Number
	Premium Plus 2 Cycle TC-W3 Outboard Oil	92-802824A1	92-802824Q1
	RTV 587 Silicone Sealer	92-809825	92-809825
	Loctite 7649 Primer N	92-809824	92-809824
	Storage Seal Rust Inhibitor	92-802878-56	92-802878Q56
	Corrosion Guard	92-802878 55	92-802878Q55
	15W40 4-cycle Diesel Engine Oil	92-877695K1	92-877695Q1
	Extended Life Antifreeze/Coolant	92-877770K1	92-877770K1
	Marine Engine Coolant	NA	92-813054A2
	Fuel System Treatment and Stabilizer Concentrate	92-802876A1	92-802876Q1
	Heat Transfer Compound	92-805701 1	
	Liquid Gasket	92-808137	NA
	T442 Sealant	92-862258	NA
	Loctite 5900 Ultra Black RTV Silicone Sealant	92-809826	NA
	Loctite Gasket Remover	92-809828 1	NA
	Sealer Kit, Two Part Epoxy	NA	92-65150 1
	Anti-seize Compound	92-881091K1	
	Torco MTF Gear Oil	92–849864–1	
	Optimol Longtime PD 2	92–848767	
	Dexron III Automatic Transmission Fluid	Obtain Locally	Obtain Locally
	Loctite 592	Obtain Locally	Obtain Locally
	Loctite Quick Tite	Obtain Locally	Obtain Locally
	Isopropyl Alcohol	Obtain Locally	Obtain Locally
	Hot Glue	Obtain Locally	Obtain Locally
	Loctite 609	Obtain Locally	Obtain Locally
	Loctite 405	Obtain Locally	Obtain Locally

Tube Ref. #	Description	Mercury Part Number	Quicksilver Part Number
	Cyanacrylate Adhesive	Obtain Locally	Obtain Locally
	3M Permabond #3M08155	Obtain Locally	Obtain Locally
	Loctite 262	Obtain Locally	Obtain Locally
	Loctite 290	Obtain Locally	Obtain Locally
	Loctite 598 RTV Sealant	Obtain Locally	Obtain Locally
	Insulating Compound	92–41669–1	

GENERAL INFORMATION & SPECIFICATIONS

Section 1B – Maintenance

1 B

Table of Contents

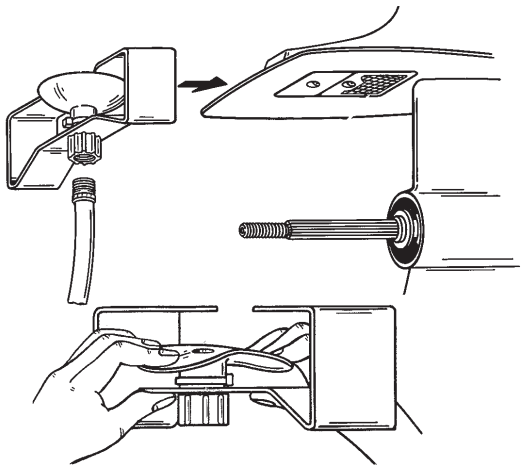
Table of Contents 1B-1
Gearcase Lubricant Capacity 1B-2
Special Tools 1B-2
Inspection and Maintenance Schedule 1B-3
Before Each Use 1B-3
After Each Use 1B-3
Every 100 Hours of Use or Once Yearly, Whichever Occurs First 1B-3
Every 300 Hours of Use or Three Years . 1B-3
Flushing The Cooling System 1B-4
Fuel System 1B-5
Fuel Line Inspection 1B-5
Engine Fuel Filter 1B-5
Corrosion Control Anode 1B-6
Spark Plug Inspection 1B-6
Battery Inspection 1B-7
Fuse Replacement – Electric Start Remote Control Models 1B-7
Lubrication Points 1B-8
Gearcase Lubrication 1B-10
Gearcase Lubricant Capacity 1B-10
Draining Gearcase 1B-10
Checking Lubricant Level and Refilling Gearcase 1B-11
Storage Preparations 1B-12
Fuel System 1B-12
Protecting External Engine Components 1B-12
Protecting Internal Engine Components . 1B-12
Gearcase 1B-12
Positioning Outboard for Storage 1B-13
Battery Storage 1B-13

Gearcase Lubricant Capacity

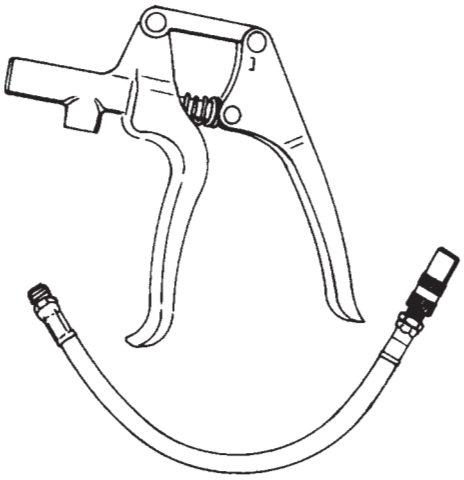
Gear Case Ratio	Capacity
2.00:1	200.0 ml (6.8 fl. oz.)

Special Tools

1. Flushing attachment 12612Q2



2. Grease gun 91-37299Q2



Inspection and Maintenance Schedule

Before Each Use

1. Check that lanyard stop switch stops the engine.
2. Visually inspect the fuel system for deterioration or leaks.
3. Check outboard for tightness on transom.
4. Check steering system for binding or loose components.
5. Visually check steering link rod fasteners for proper tightness.
6. Check propeller blades for damage.

After Each Use

1. Flush out the outboard cooling system if operating in salt or polluted water.
2. Wash off all salt deposits and flush out the exhaust outlet of the propeller and gearcase with fresh water if operating in salt water.

Every 100 Hours of Use or Once Yearly, Whichever Occurs First

1. Lubricate all lubrication points. Lubricate more frequently when used in salt water.
2. Inspect and clean spark plugs.
3. Check fuel line filter for contaminants.
4. Check carburetor adjustments, if required.
5. Check corrosion control anodes. Check more frequently when used in salt water.
6. Drain and replace gearcase lubricant.
7. Lubricate splines on the drive shaft.*
8. Electric start models – Inspect battery.
9. Remote control models – Check control cable adjustments. *
10. Remove engine deposits with Power Tune Engine Cleaner.
11. Check tightness of bolts, nuts, and other fasteners.
12. Clean fuel tank pick up filter.

Every 300 Hours of Use or Three Years

1. Replace water pump impeller (more often if overheating occurs or reduced water pressure is noted).*

* *These items should be serviced by an authorized dealer.*

Flushing The Cooling System

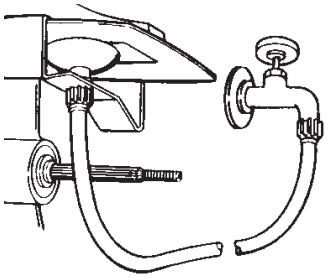
Flush the internal water passages of the outboard with fresh water after each use in salt, polluted, or muddy water. This will help prevent a buildup of deposits from clogging the internal water passages.

Use a Quicksilver accessory or equivalent flushing attachment.

⚠ WARNING

To avoid possible injury when flushing, remove the propeller. Refer to Propeller Replacement.

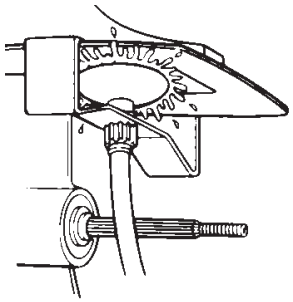
1. Remove propeller (refer to Propeller Replacement). Install the flushing attachment so the rubber cups fit tightly over the cooling water intake holes.



⚠ CAUTION

Never start or run your outboard (even momentarily) without water circulating through the cooling water intake in the gearcase to prevent damage to the water pump (running dry) or overheating of the engine.

2. Attach a water hose to the flushing attachment. Turn on the water and adjust the flow so water is leaking around the rubber cups to ensure the engine receives an adequate supply of cooling water.
3. Start the engine and run it at idle speed in neutral shift position.
4. Adjust water flow if necessary so excess water continues leaking out from around the rubber cups to ensure the engine is receiving an adequate supply of cooling water.



5. Check for a steady stream of water flowing out of the water pump indicator hole. Continue flushing the outboard for 3 to 5 minutes, carefully monitoring water supply at all times.
6. Stop the engine, turn off the water, and remove the flushing attachment. Reinstall the propeller.

Fuel System

⚠ WARNING

Avoid serious injury or death from gasoline fire or explosion. Carefully follow all fuel system service instructions. Always stop the engine and DO NOT smoke or allow open flames or sparks in the area while servicing any part of the fuel system.

Before servicing any part of the fuel system, stop engine and disconnect the battery. Drain the fuel system completely. Use an approved container to collect and store fuel. Wipe up any spillage immediately. Material used to contain spillage must be disposed of in an approved receptacle. Any fuel system service must be performed in a well ventilated area. Inspect any completed service work for sign of fuel leakage.

Fuel Line Inspection

Visually inspect the fuel line and primer bulb for cracks, swelling, leaks, hardness or other signs of deterioration or damage. If any of these conditions are found, the fuel line or primer bulb must be replaced.

Engine Fuel Filter

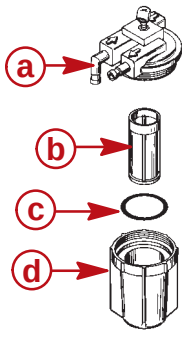
Inspect the sight bowl for water accumulation and inspect the filter element for sediment. Clean filter as follows.

REMOVAL

1. Hold onto the filter cover cover to prevent it from turning.
2. Turn off the sight bowl.
3. Pull out the filter element and wash it with cleaning solvent.

INSTALLATION

4. Push the open end of the filter element, into cover.
5. Place the O-ring seal into the sight bowl and screw the sight bowl hand tight into the cover.



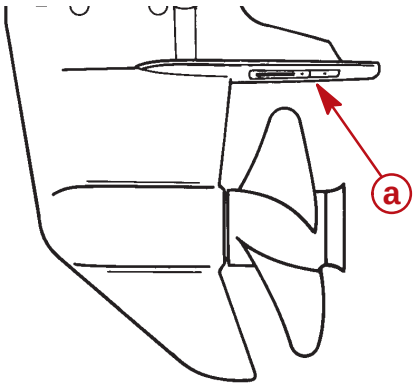
a - Filter cover
b - Filter
c - O-ring
d - Sight bowl

6. Visually inspect for fuel leakage around the sight bowl by squeezing the primer bulb until firm, forcing fuel into the sight bowl.

Corrosion Control Anode

The outboard has a corrosion control anode installed to the gear case. An anode helps protect the outboard against galvanic corrosion by sacrificing its metal to be slowly eroded instead of the outboard metals.

1. The anode requires periodic inspection especially in salt water which will accelerate the erosion. To maintain this corrosion protection, always replace the anode before it is completely eroded. Never paint or apply a protective coating on the anode as this will reduce effectiveness of the anode.

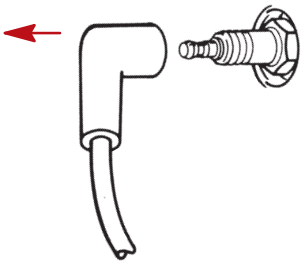


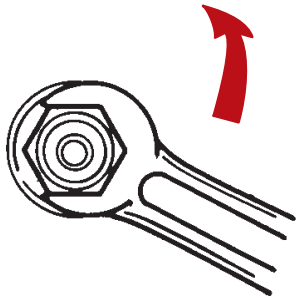
a - Anode

Spark Plug Inspection

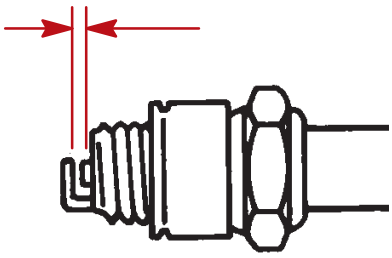
Inspect spark plugs at the recommended intervals.

1. Remove the spark plug leads by twisting the rubber boots slightly and pull off.
2. Remove the spark plugs to inspect and clean. Replace spark plug if electrode is worn or the insulator is rough, cracked, broken, blistered or fouled.





3. Set the spark plug gap. See Specification Chart in General Information Section.



4. Before reinstalling spark plugs, clean away dirt on the spark plug seats. Install plugs finger tight, and tighten 1/4 turn or torque to 27 N·m (20 lb. ft.).

Battery Inspection

The battery should be inspected at periodic intervals to ensure proper engine starting capability.

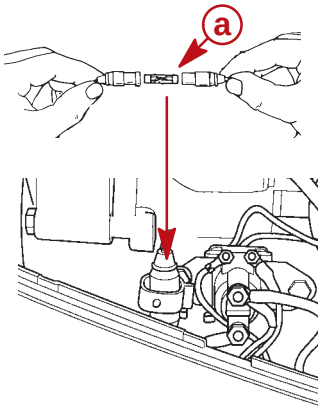
IMPORTANT: Read the safety and maintenance instructions which accompany your battery.

1. Turn off the engine before servicing the battery.
2. Add water as necessary to keep the battery full.
3. Make sure the battery is secure against movement.
4. Battery cable terminals should be clean, tight, and correctly installed. Positive to positive and negative to negative.
5. Make sure the battery is equipped with a nonconductive shield to prevent accidental shorting of battery terminals.

Fuse Replacement – Electric Start Remote Control Models

The electric starting circuit is protected from overload by a SFE 20 AMP fuse. If the fuse is blown, the electric starter motor will not operate. Locate and correct the cause of the overload. If the cause is not found, the fuse may blow again. Replace the fuse with a fuse of the same rating.

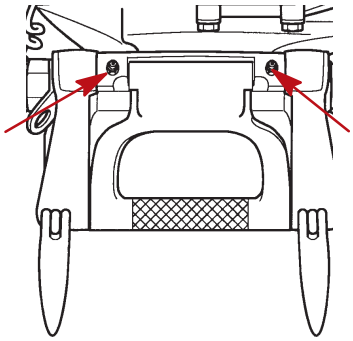
1. Replace with a new SFE 20 AMP fuse.



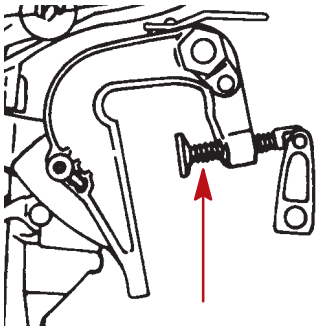
a - SFE 20 amp fuse

Lubrication Points

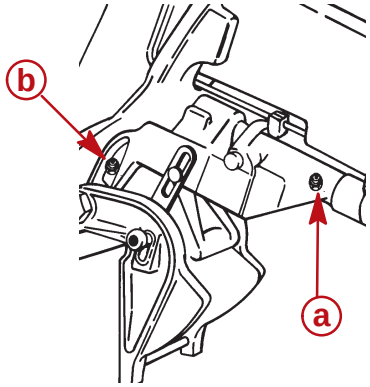
1. Lubricate the following with 2-4-C with Teflon or Special Lubricant 101.
   - Tilt tube.



   - Transom clamp screws.

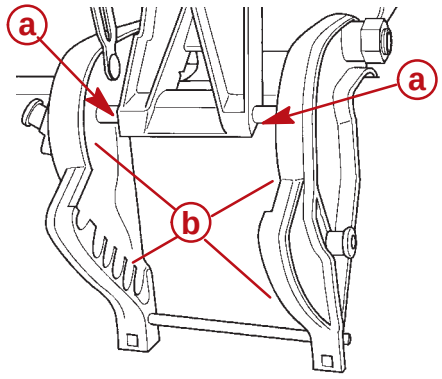


   - Swivel bracket.
   - Steering friction adjustment shaft (tiller handle models).



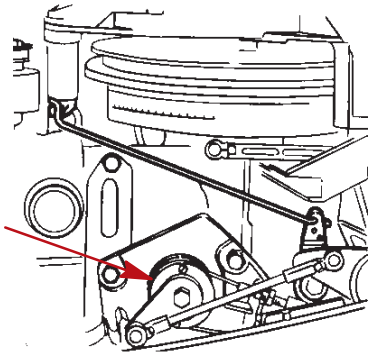
a - Swivel bracket
b - Steering friction adjustment shaft

- Tilt lock pins (Make sure this pin is free to push in and out).
- Lubricate along the entire tilt pin track on both transom brackets.



a - Tilt lock pins
b - Tilt pin track

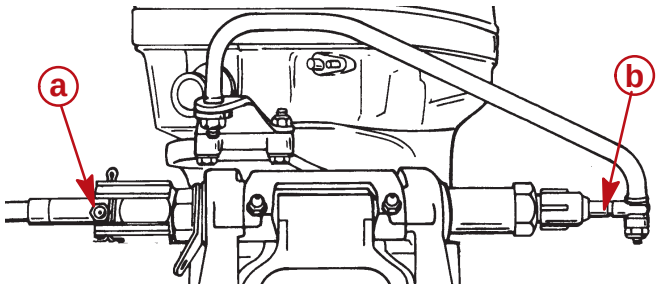
- Lubricate the throttle and shaft cables, moving components and pivot locations.



⚠ WARNING

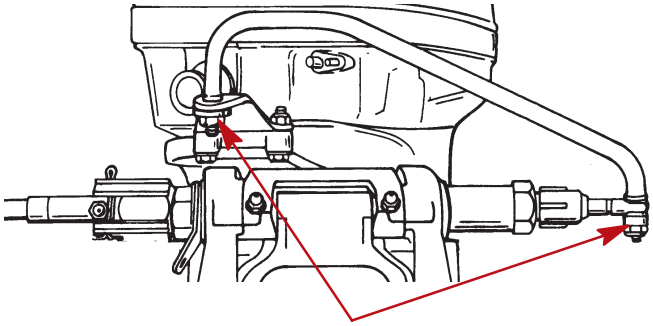
The end of the steering cable must be fully retracted into the outboard tilt tube before adding lubricant. Adding lubricant to steering cable when fully extended could cause steering cable to become hydraulically locked. An hydraulically locked steering cable will cause loss of steering control, possibly resulting in serious injury or death.

- Rotate steering wheel (if so equipped) to fully retract the steering cable end into the outboard tilt tube. Lubricate steering cable through grease fitting and cable end.

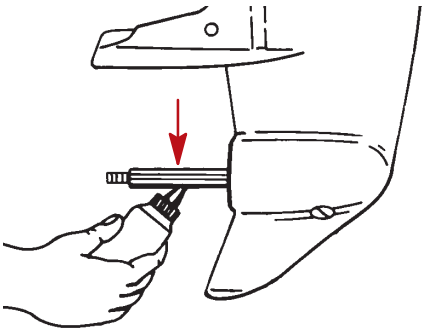


a - Grease fitting
b - Steering cable end

2. Lubricate the following with light weight oil.
   - Steering Link Rod Pivot Points.



3. Lubricate the following with anti-corrosion grease or 2-4-C with Teflon.
   - Coat the entire propeller shaft with lubricant to prevent the propeller hub from corroding to the shaft.



Gearcase Lubrication

Gearcase Lubricant Capacity

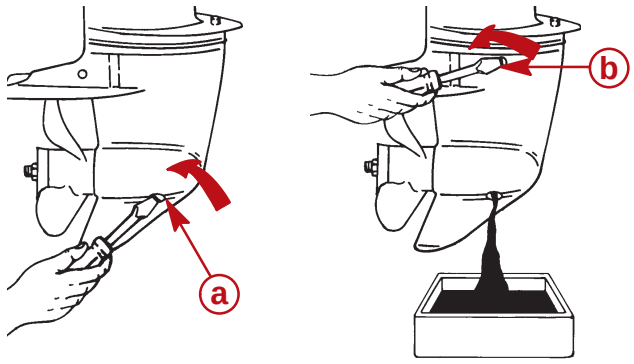
Gear Case Ratio	Capacity
2.00:1	200.0 ml (6.8 fl. oz.)

Draining Gearcase

When adding or changing gearcase lubricant, visually check for the presence of water in the lubricant. If water is present, it may have settled to the bottom and will drain out prior to the lubricant, or it may be mixed with the lubricant, giving it a milky colored appearance. If water is noticed, have the gearcase checked by your dealer. Water in the lubricant may result in premature bearing failure or, in freezing temperatures, will turn to ice and damage the gearcase.

Whenever you remove the fill/drain plug, examine the magnetic end for metal particles. A small amount of metal filings or fine metal particles indicates normal gear wear. An excessive amount of metal filings or larger particles (chips) may indicate abnormal gear wear and should be checked by an authorized dealer.

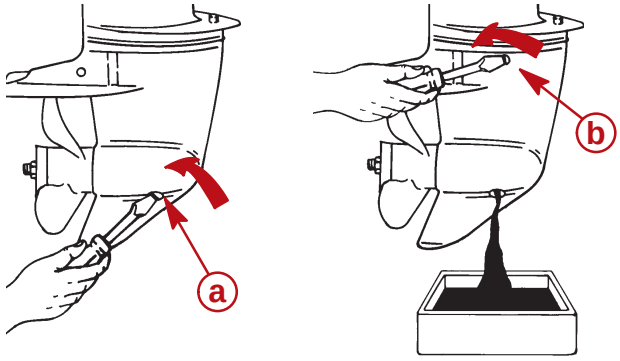
1. Place outboard in a vertical operating position.
2. Place drain pan below outboard.
3. Remove fill/drain plug and vent plug and drain lubricant.



a - Fill/Drain Plug
b - Vent plug

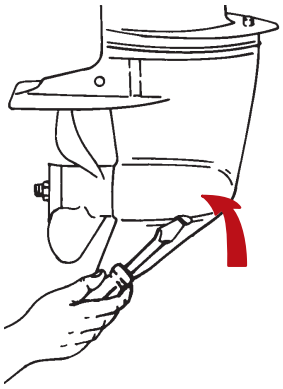
Checking Lubricant Level and Refilling Gearcase

1. Place outboard in a vertical operating position.
2. Remove vent plug from vent hole.
3. Place lubricant tube into the fill hole and add lubricant until it appears at the vent hole.
4. Stop adding lubricant. Install the vent plug and sealing washer before removing the lubricant tube.



a - Fill/Drain plug
b - Vent plug

5. Remove lubricant tube and reinstall cleaned fill/drain plug and sealing washer.



Storage Preparations

Fuel System

IMPORTANT: Gasoline containing alcohol (ethanol or methanol) can cause a formation of acid during storage and can damage the fuel system. If the gasoline being used contains alcohol, It is advisable to drain as much of the remaining gasoline as possible from the fuel tank, remote fuel line, and engine fuel system.

Fill the fuel system (tank, hoses, fuel pumps, and fuel injection systems) with treated (stabilized) fuel to help prevent formation of varnish and gum. Proceed with following instructions.

1. Portable fuel tank – Pour the required amount of fuel system/stabilizer concentrate (follow instructions on container) into fuel tank. Tip fuel tank back and forth to mix stabilizer with the fuel.
2. Permanently Installed Fuel Tank – Pour the required amount of fuel system/stabilizer concentrate (follow instructions on container) into a separate container and mix with approximately one liter (one quart) of gasoline. Pour mixture into fuel tank.
3. Place the outboard in water or connect flushing attachment. Run the engine for ten minutes to allow treated fuel to fill the fuel system.

Protecting External Engine Components

1. Lubricate all outboard components listed in the **Inspection and Maintenance Schedule**.
2. Touch up any paint nicks.
3. Spray Corrosion Guard on external metal surfaces (except corrosion control anodes).

Protecting Internal Engine Components

NOTE: *Before performing Steps 1 and 2, make sure the fuel system has been prepared for storage.*

1. Place the outboard in water or connect flushing attachment. Start the engine and let it run in neutral to warm up.
2. With engine running at fast idle, stop the fuel flow by disconnecting the remote fuel line. When engine begins to stall, quickly spray Storage Seal Rust Inhibitor into carburetor until engine stops from lack of fuel.
3. Remove the spark plugs and inject a five second spray of Storage Seal Rust Inhibitor around the inside of each cylinder.
4. Rotate the flywheel manually several times to distribute the Storage Seal in the cylinders. Reinstall spark plugs.

Gearcase

Drain and refill the gearcase lubricant. Refer to **Refilling Gearcase**

Positioning Outboard for Storage

Store outboard in an upright position to allow water to drain out of outboard.

⚠ CAUTION

If outboard is stored tilted up in freezing temperature, trapped cooling water or rain water that may have entered the propeller exhaust outlet in the gearcase could freeze and cause damage to the outboard.

Battery Storage

1. Follow the battery manufacturers instructions for storage and recharging.
2. Remove the battery from the boat and check water level. Recharge if necessary.
3. Store the battery in a cool, dry place.
4. Periodically check the water level and recharge the battery during storage.

GENERAL INFORMATION & SPECIFICATIONS

Section 1C – General Information

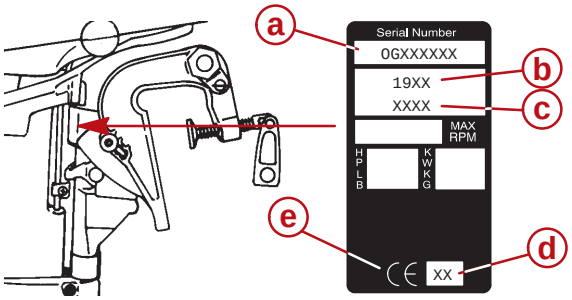
1C

Table of Contents

Table of Contents 1C-1
Serial Number Location 1C-1
Conditions Affecting Performance 1C-2
Weather 1C-2
Boat 1C-3
Engine 1C-4
Following Complete Submersion 1C-5
Submerged While Running 1C-5
Fresh Water Submersion 1C-5
Salt Water Submersion 1C-5
Propeller Selection 1C-6
Propeller Removal/Installation 1C-7
Compression Check 1C-9
Painting Procedures 1C-9
Cleaning & Painting Aluminum Propellers & Gear Housings 1C-9
Decal Application 1C-11
Decal Removal 1C-11
Instructions for Wet Application 1C-11

Serial Number Location

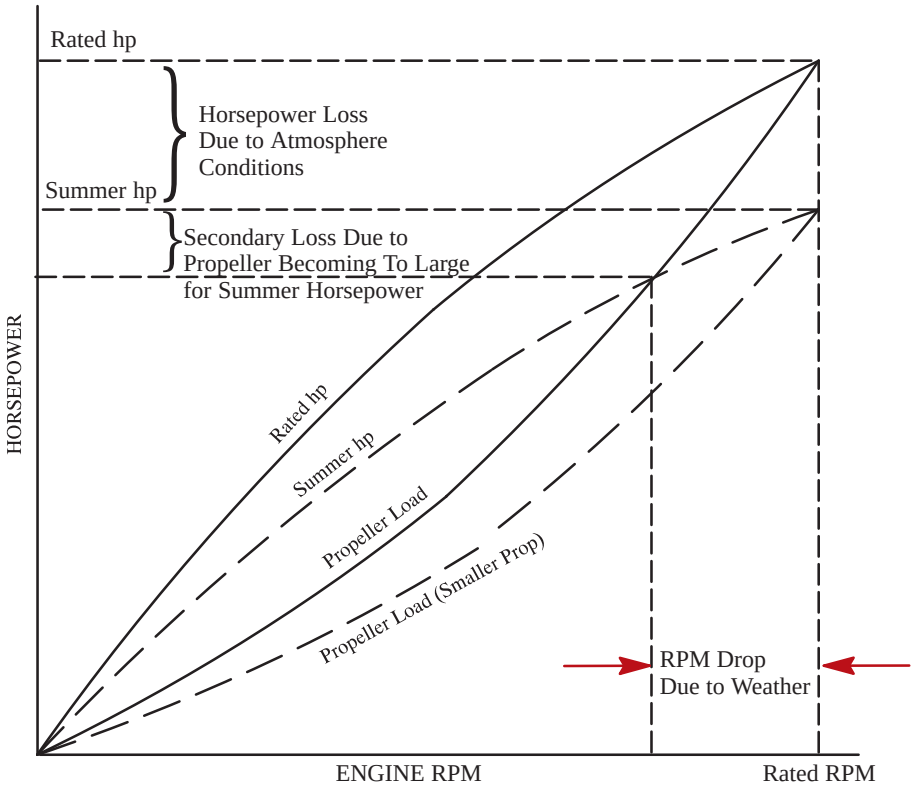
The Outboard serial number is located on the lower starboard side of the engine block. A serial number is also located on the starboard side of the swivel bracket.



a - Serial number
b - Model year
c - Model description
d - Year manufactured
e - Certified Europe insignia

Conditions Affecting Performance

Weather



It is a known fact that weather conditions exert a profound effect on power output of internal combustion engines. Therefore, established horsepower ratings refer to the power that the engine will produce at its rated RPM under a specific combination of weather conditions.

Corporations internationally have settled on adoption of I.S.O. (International Standards Organization) engine test standards, as set forth in I.S.O. 3046 standardizing the computation of horsepower from data obtained on the dynamometer. All values are corrected to the power that the engine will produce at sea level, at 30% relative humidity, at 25° C (77° F) temperature and a barometric pressure of 29.61 inches of mercury.

Summer conditions of high temperature, low barometric pressure and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds--as much as 3 or 5 Km per-hour (2 or 3 miles-per-hour) in some cases. (Refer to previous chart.) Nothing will regain this speed for the boater, but the coming of cool, dry weather.

In pointing out the practical consequences of weather effects, an engine--running on a hot, humid summer day--may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk spring or fall day. The horsepower, that any internal combustion engine produces, depends upon the density of the air that it consumes, and in turn, this density is dependent upon the temperature of the air, its barometric pressure and water vapor (or humidity) content.

Accompanying this weather-inspired loss of power is a second but more subtle loss. At rigging time in early spring, the engine was equipped with a propeller that allowed the engine to turn within its recommended RPM range at full throttle. With the coming of the summer weather and the consequent drop in available horsepower, this propeller will, in effect, become too large. Consequently, the engine operates at less than its recommended RPM.

Due to the horsepower/RPM characteristics of an engine, this will result in further loss of horsepower at the propeller with another decrease in boat speed. This secondary loss, however, can be regained by switching to a smaller pitch propeller that allows the engine to again run at recommended RPM.

For boaters to realize optimum engine performance under changing weather conditions, it is essential that the engine have the proper propeller to allow it to operate at or near the top end of the recommended maximum RPM range at wide-open-throttle with a normal boat load.

Not only does this allow the engine to develop full power, but equally important is the fact that the engine also will be operating in an RPM range that discourages damaging detonation. This, of course, enhances overall reliability and durability of the engine.

Boat

WEIGHT DISTRIBUTION

1. Proper positioning of the weight inside the boat (persons and gear) has a significant effect on the boat's performance, for example:
   a. Shifting weight to the rear (stern)
      (1.) Generally increases top speed.
      (2.) If in excess, can cause the boat to porpoise.
      (3.) Can make the bow bounce excessively in choppy water.
      (4.) Will increase the danger of the following - wave splashing into the boat when coming off plane.
   b. Shifting weight to the front (bow)
      (1.) Improves ease of planing off.
      (2.) Generally improves rough water ride.
      (3.) If excessive, can make the boat veer left and right (bow steer).

BOTTOM

For maximum speed, a boat bottom should be nearly a flat plane where it contacts the water and particularly straight and smooth in fore-and-aft direction.

1. **Hook:** Exists when bottom is concave in fore-and-aft direction when viewed from the side. When boat is planing, hook causes more lift on bottom near transom and allows bow to drop, thus greatly increasing wetted surface and reducing boat speed. Hook frequently is caused by supporting boat too far ahead of transom while hauling on a trailer or during storage.
2. **Rocker:** The reverse of hook and much less common. Rocker exists if bottom is convex in fore-and-aft direction when viewed from the side, and boat has strong tendency to porpoise.
3. **Surface Roughness:** Moss, barnacles, etc., on boat or corrosion of outboard's gear housing increase skin friction and cause speed loss. Clean surfaces when necessary.

WATER ABSORPTION

It is imperative that all through hull fasteners be coated with a quality marine sealer at time of installation. Water intrusion into the transom core and/or inner hull will result in additional boat weight (reduced boat performance), hull decay and eventual structural failure.

CAVITATION

Cavitation is caused by water vapor bubbles forming either from a sharp edge or angle on the gear case or from an irregularity in the propeller blade itself. These vapor bubbles flow back and collapse when striking the surface of the propeller blade resulting in the erosion of the propeller blade surface. If allowed to continue, eventual blade failure (breakage) will occur.

Engine

DETONATION

Detonation in a 2-cycle engine resembles the pinging heard in an automobile engine. It can be otherwise described as a tin-like rattling or plinking sound.

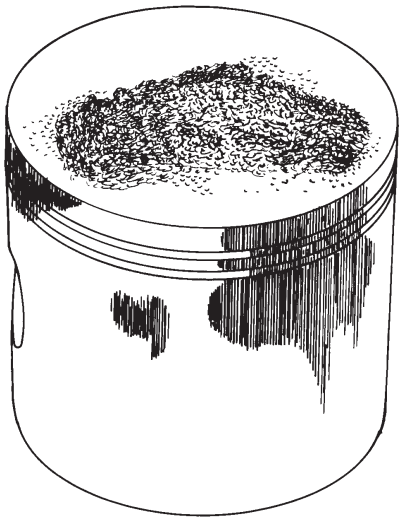
Detonation is an explosion of an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, cylinder head/gasket, piston rings or piston ring lands, piston pin and roller bearings.

A few of the most common causes of detonation in a marine 2-cycle application are as follows:

- Over-advanced ignition timing.
- Use of low octane gasoline.
- Propeller pitch too high (engine RPM below recommended maximum range).
- Lean fuel mixture at or near wide-open-throttle.
- Spark plugs (heat range too hot - incorrect reach - cross-firing).
- Inadequate engine cooling (deteriorated cooling system).
- Combustion chamber/piston deposits (result in higher compression ratio).

Detonation usually can be prevented if:

1. The engine is correctly set up.
2. Diligent maintenance is applied to combat the detonation causes.



51115

Damaged Piston Resulting from Detonation

Following Complete Submersion

Submerged While Running

When an engine is submerged while running, the possibility of internal engine damage is greatly increased. If, after engine is recovered and with spark plugs removed, engine fails to turn over freely when turning flywheel, the possibility of internal damage (bent connecting rod and/or bent crankshaft) exists. If this is the case, the powerhead must be disassembled.

Fresh Water Submersion

1. Recover engine as quickly as possible.
2. Remove cowling.
3. Flush exterior of outboard with fresh water to remove mud, weeds, etc. DO NOT attempt to start engine if sand has entered powerhead, as powerhead will be severely damaged. Disassemble powerhead if necessary to clean components.
4. Remove spark plugs and get as much water as possible out of powerhead. Most water can be eliminated by placing engine in a horizontal position (with spark plug holes down) and rotating flywheel.
5. Pour alcohol into carburetor throats (alcohol will absorbed water). Again rotate flywheel.
6. Turn engine over and pour alcohol into spark plug openings and rotate flywheel.
7. Turn engine over (place spark plug openings down) and pour engine oil into throat of carburetors while rotating flywheel to distribute oil throughout crankcase.
8. Again turn engine over and pour approximately one teaspoon of engine oil into each spark plug opening. Again rotate flywheel to distribute oil in cylinders.
9. Remove and clean carburetors and fuel pump assembly.
10. Dry all wiring and electrical components using compressed air.
11. Disassemble the engine starter motor and dry the brush contacts, armature and other corrodible parts.
12. Reinstall spark plugs, carburetors and fuel pump.
13. Attempt to start engine, using a fresh fuel source. If engine starts, it should be run for at least one hour to eliminate any water in engine.
14. If engine fails to start, determine cause (fuel, electrical or mechanical). Engine should be run within 2 hours after recovery of outboard from water, or serious internal damage may occur. If unable to start engine in this period, disassemble engine and clean all parts. Apply oil as soon as possible.

Salt Water Submersion

Due to the corrosive effect of salt water on internal engine components, complete disassembly is necessary before any attempt is made to start the engine.

Propeller Selection

For in-depth information on marine propellers and boat performance see your Authorized Dealer for the illustrated **What You Should Know About Quicksilver Propellers... and Boat Performance Information** (Part No. 90-86144 92).

For best all around performance from your outboard/boat combination, select a propeller that allows the engine to operate in the upper half of the recommended full throttle RPM range with the boat normally loaded (refer to **Section 1A - Specifications**). This RPM range allows for better acceleration while maintaining maximum boat speed.

If changing conditions cause the RPM to drop below the recommended range (such as warmer, more humid weather, operation at higher elevations, increased boat load or a dirty boat bottom/gear case) a propeller change or cleaning may be required to maintain performance and ensure the outboard's durability.

Check full-throttle RPM using an accurate tachometer with the engine trimmed out to a balanced-steering condition (steering effort equal in both directions) without causing the propeller to break loose.

Refer to **Mercury Precision Parts/Quicksilver Accessory Guide** for a complete list of available propellers.

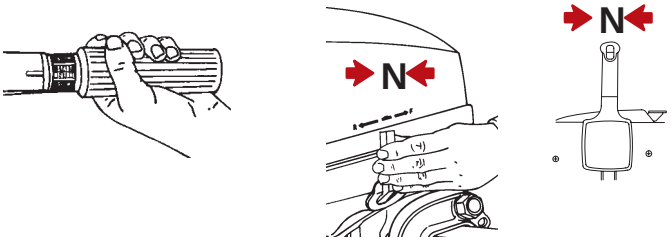
1. Select a propeller that will allow the engine to operate at or near the top of the recommended full throttle RPM range (refer to **Section 1A - Specifications** preceding) with a normal load. Maximum engine speed (RPM) for propeller selection exists when boat speed is maximum and trim is minimum for that speed. (High RPM, caused by an excessive trim angle, should not be used in determining correct propeller.) Normally, there is a 150-350 RPM change between propeller pitches.
2. If full throttle operation is below the recommended range, the propeller must be changed to one with a lower pitch to prevent loss of performance and possible engine damage.
3. After initial propeller installation, the following common conditions may require that the propeller be changed to a lower pitch:
    a. Warmer weather and great humidity will cause an RPM loss.
    b. Operating in a higher elevation causes an RPM loss.
    c. Operating with a damaged propeller or a dirty boat bottom or gear housing will cause an RPM loss.
    d. Operation with an increased load (additional passengers, equipment, pulling skiers, etc.).

Propeller Removal/Installation

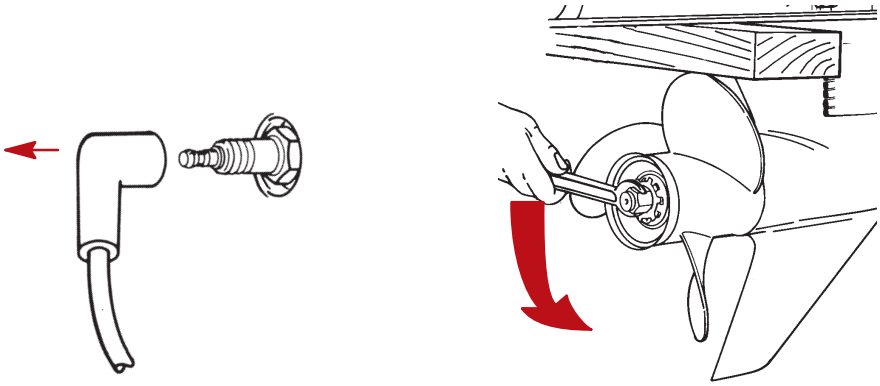
⚠ WARNING

If the propeller shaft is rotated while the engine is in gear, there is the possibility that the engine will crank over and start. To prevent this type of accidental engine starting and possible serious injury caused from being struck by a rotating propeller, always shift outboard to neutral position and remove spark plug leads when you are servicing the propeller.

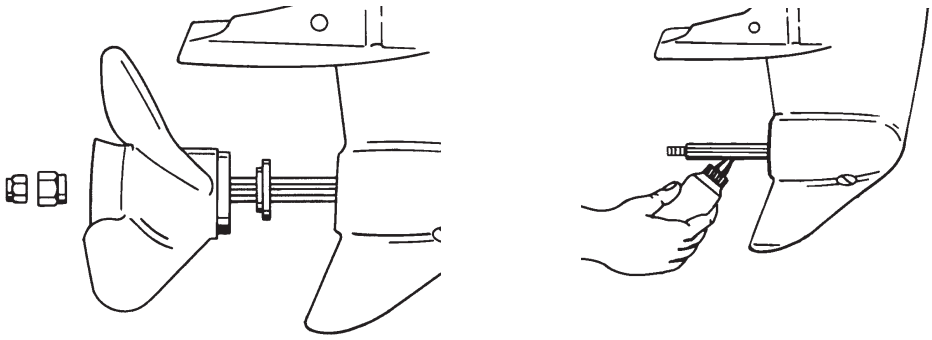
1. Shift outboard to neutral position.



2. Remove the spark plug leads to prevent engine from starting.
3. Place a block of wood between gear case and propeller to hold propeller and remove propeller nut.

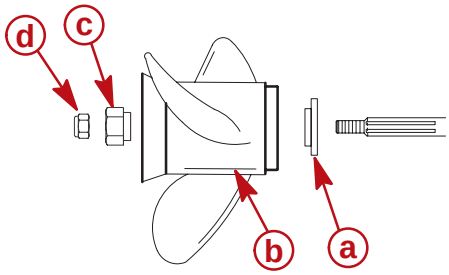


4. Pull propeller straight off shaft. If propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.
5. Coat the propeller shaft with Anti-Corrosion Grease or 2-4-C with Teflon.



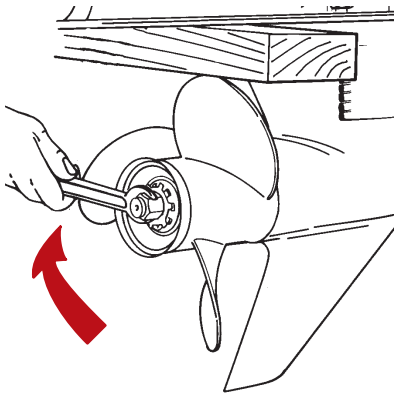
IMPORTANT: To prevent the propeller hub from corroding and seizing to the propeller shaft, especially in salt water, always apply a coat of the recommended lubricant to the entire propeller shaft at the recommended maintenance intervals and also each time the propeller is removed.

6. Install forward thrust hub, propeller, rear thrust hub and propeller nut onto the shaft.



a - Forward thrust hub
b - Propeller
c - Rear thrust hub
d - Propeller nut

7. Place a block of wood between gear case and propeller and tighten propeller nut.



Compression Check

Normal Compression (All Models)	787 – 856 kPa (115 – 125 psi)

1. Remove spark plugs.
2. Install compression gauge in spark plug hole.
3. Hold throttle plate at W.O.T.
4. Crank the engine over until the compression reading peaks.
5. Check and record compression of each cylinder. The difference in compression readings between each cylinder should not vary more than 15%. If compression varies by more than 15% or compression for both cylinders is less than 685kPa (100psi), the powerhead should be disassembled and inspected.
6. Compression check is important because an engine with low or uneven compression cannot be tuned successfully to give peak performance. It is essential, therefore, that improper compression be corrected before proceeding with an engine tuneup.
7. Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, visually inspect cylinders for scoring or other damage. Refer to **Section 4 Powerhead.**

Painting Procedures

Cleaning & Painting Aluminum Propellers & Gear Housings

⚠ WARNING

Avoid serious injury from flying debris. Avoid serious injury from airborne particles. Use eye and breathing protection with proper ventilation.

PROPELLERS

1. Sand the entire area to be painted with 3M 120 Regalite Polycut or coarse Scotch-Brite, disc or belts.
2. Feather edges of all broken paint edges. Try not to sand through the primer.
3. Clean the surface to be painted using PPG Industries DX330 Wax and Grease Remover or equivalent (Xylene or M.E.K.).
4. If bare metal has been exposed, use Mercury/Quicksilver's Light Gray Primer.
5. Allow a minimum of 1 hour dry time and no more than 1 week before applying the finish coat.
6. Apply the finish coat using Mercury/Quicksilver's EDP Propeller Black.

GEAR HOUSINGS

The following procedures should be used in refinishing gear housings. This procedure will provide the most durable paint system available in the field. The materials recommended are of high quality and approximate marine requirements. The following procedure will provide a repaint job that compares with a properly applied factory paint finish. It is recommended that the listed materials be purchased from a local Ditzler Automotive Finish Supply Outlet. The minimum package quantity of each material shown following is sufficient to refinish several gear housings.

Procedure:

1. Wash gear housing with a muriatic acid base cleaner to remove any type of marine growth, and rinse with water, if necessary.
2. Wash gear housing with soap and water, then rinse.
3. Sand blistered area with 3M 180 grit sandpaper or P180 Gold Film Disc to remove paint blisters only. Feather edge all broken paint edges.
4. Clean gear housing thoroughly with (DX-330) wax and grease remover.
5. Spot repair surfaces where bare metal is exposed with (DX-503) alodine treatment.

IMPORTANT: Do not use any type of aerosol spray paints as the paint will not properly adhere to the surface nor will the coating be sufficiently thick to resist future paint blistering.

6. Mix epoxy chromate primer (DP-90LF) with equal part catalyst (DP-402LF) per manufacturers instructions, allowing proper induction period for permeation of the epoxy primer and catalyst.
7. Allow a minimum of one hour drying time and no more than one week before top coating assemblies.
8. Use Ditzler Urethane DU9300 for Mercury Black, DU34334 for Mariner Grey, and DU35466 for Force Charcoal, and DU33414 for Sea Ray White. Catalyze all three colors with Ditzler DU5 catalyst mixed 1:1 ratio. Reduce with solvents per Ditzler label.

⚠ CAUTION

Be sure to comply with instructions on the label for ventilation and respirators. Using a spray gun, apply one half to one mil even film thickness. Let dry, flash off for five minutes and apply another even coat of one half to one mil film thickness. This urethane paint will dry to the touch in a matter of hours, but will remain sensitive to scratches and abrasions for a few days.

9. The type of spray gun used will determine the proper reduction ratio of the paint.

IMPORTANT: Do not paint sacrificial zinc trim tab or zinc anode.

10. Cut out a cardboard plug for trim tab pocket to keep paint off of mating surface to maintain good continuity circuitry between trim tab and gear housing.

Decal Application

Decal Removal

1. Mark decal location before removal to assure proper alignment of new decal.
2. Carefully soften decal and decal adhesive with a heat gun or heat blower while removing old decal.
3. Clean decal contact area with a 1:1 mixture of isopropyl alcohol and water.
4. Thoroughly dry decal contact area and check for a completely cleaned surface.

Instructions for Wet Application

NOTE: *The following decal installation instructions are provided for a wet installation.* ***All*** *decals should be applied wet.*

TOOLS REQUIRED

1. Plastic Squeegee*
2. Stick Pin
3. Dish Washing liquid detergent without ammonia**.** Do not use a soap that contains petroleum based solvents.

* Automotive body filler squeegee.

SERVICE TIP: Placement of decals using the wet application will allow time to position decal. Read entire installation instructions on this technique before proceeding.

TEMPERATURE

IMPORTANT: Installation of vinyl decals should not be attempted while in direct sunlight. Air and surface temperature should be between 15°C (60°F) and 38°C (100°F) for best application.

SURFACE PREPARATION

IMPORTANT: Do not use a soap or any petroleum based solvents to clean application surface.

Clean entire application surface with mild dish washing liquid and water. Rinse surface thoroughly with clean water.

DECAL APPLICATION

1. Mix 16 ml ($^1/_2$ ounce) of dish washing liquid in 4 literes (1 gallon) of cool water to use as wetting solution.

NOTE: *Leave protective masking, if present, on the face of decal until final steps of decal installation. This will ensure that the vinyl decal keeps it's shape during installation.*

2. Place the decal face down on a clean work surface and remove the paper backing from adhesive side of decal.
3. Using a spray bottle, flood the entire adhesive side of the decal with the pre-mixed wetting solution.
4. Flood area where the decal will be positioned with wetting solution.
5. Position pre-wetted decal on wetted surface and slide into position.
6. Starting at the center of the decal, lightly squeegee out the air bubbles and wetting solution with overlapping strokes to the outer edge of the decal. Continue going over the decal surface until all wrinkles are gone and adhesive bonds to the cowl surface.
7. Wipe decal surface with soft paper towel or cloth.
8. Wait 10 - 15 minutes.
9. Starting at one corner, carefully and slowly pull the masking off the decal surface at a 180° angle.

NOTE: *To remove any remaining bubbles, pierce the decal at one end of the bubble with stick pin and press out the entrapped air or wetting solution with your thumb (moving toward the puncture).*

GENERAL INFORMATION & SPECIFICATIONS

Section 1D – Outboard Installation

1 D

Table of Contents

Notice to Installer and Owner 1D-1
Boat Horsepower Capacity 1D-1
Outboard Remote Control 1D-2
Selecting Accessories For The Outboard 1D-2
Selecting Steering Cables and Remote Control Cables 1D-2
Installing Outboard 1D-3
Steering Cable and Steering Link Rod Installation 1D-3
Installing Ride Guide Steering Cable to the Outboard 1D-3
Steering Cable Seal 1D-4
Steering Link Rod Installation 1D-5
Remote Control Installation 1D-7
Shift and Throttle Cable Installation to the Outboard 1D-7
Remote Wiring Harness Connection to Engine 1D-13
Battery Cable Connections 1D-14
Tilt Pin Adjustment 1D-15
Placing Tilt Pin in Lower Holes 1D-15
Placing Tilt Pin in Upper Holes 1D-15

Notice to Installer and Owner

This manual as well as safety labels posted on the outboard use the following safety alerts to draw your attention to special safety instructions that should be followed.

⚠ DANGER

DANGER – Immediate hazards which will result in severe personal injury or death.

⚠ WARNING

WARNING – Hazards or unsafe practices which could result in severe personal injury or death.

⚠ CAUTION

CAUTION – Hazards or unsafe practices which could result in minor injury or product or property damage.

Boat Horsepower Capacity

U.S. COAST GUARD CAPACITY	
MAXIMUM HORSEPOWER	XXX
MAXIMUM PERSON CAPACITY (POUNDS)	XXX
MAXIMUM WEIGHT CAPACITY	XXX

Do not overpower or overload your boat. Most boats will carry a required capacity plate indicating the maximum acceptable power and load as determined by the manufacturer following certain federal guidelines. If in doubt, contact your dealer or the boat manufacturer.

⚠ WARNING

Using an outboard that exceeds the maximum horsepower limit of a boat can: 1) cause loss of boat control 2) place too much weight at the transom altering the designed flotation characteristics of the boat or 3) cause the boat to break apart particularly around the transom area. Overpowering a boat can result in serious injury, death, or boat damage.

Outboard Remote Control

The remote control connected to your outboard must be equipped with a start in gear protection device. This prevents the engine from starting when the outboard is in gear.

⚠ WARNING

Avoid serious injury or death from a sudden unexpected acceleration when starting your engine. The design of this outboard requires that the remote control used with it must have a built in start in gear protection device.

Selecting Accessories For The Outboard

Mercury Marine Quicksilver Accessories have been specifically designed and tested for your outboard.

Mercury Marine Quicksilver accessories are available from Mercury Marine dealers.

Some accessories not manufactured or sold by Mercury Marine are not designed to be safely used with your outboard or outboard operating system. Acquire and read the installation, operation, and maintenance manuals for all your selected accessories.

Selecting Steering Cables and Remote Control Cables

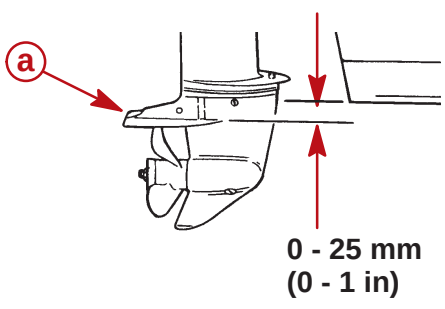
Install steering mount and steering wheel in accordance with installation instructions that accompany each.

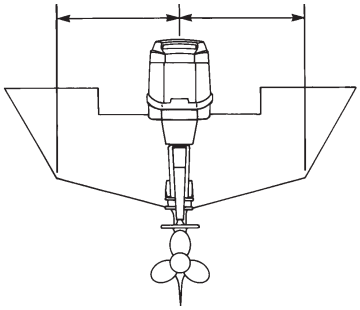
IMPORTANT: Steering cable must be correct length. Sharp bends on too-short of a cable result in kinks; too-long of a cable require unnecessary bends and/or loops. Both conditions place extra stress on the cable.

Refer to **Mercury Precision Parts/Quicksilver Accessories Guide** to determine correct length of steering cable.

Installing Outboard

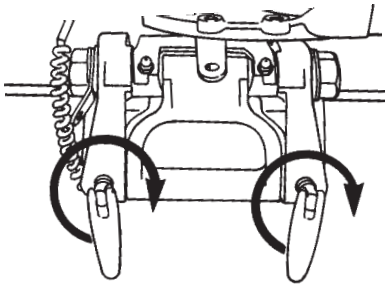
1. Measure the transom height of your boat. The boat bottom should be aligned or be within 25 mm (1 in.) above the anti-ventilation plate of the outboard.
2. Place outboard on center line of transom.

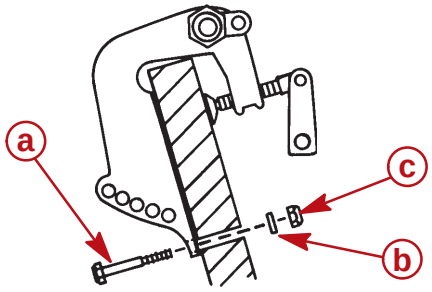




a - Anti-Ventilation Plate

3. Tighten transom clamp handles.
4. To prevent loss of outboard overboard, fasten outboard by drilling two 7.9 mm (5/16 in.) holes through the transom using transom clamp holes as a template. Fasten with two bolts, flat washers and locknuts. Use a marine waterproofing sealer in holes and around bolts to make the installation water tight.





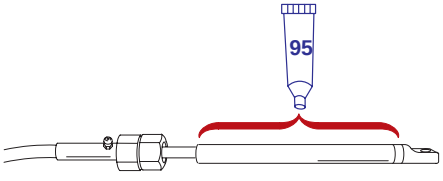
a - Bolts (2)
b - Flat washers (2)
c - Locknuts (2)

Steering Cable and Steering Link Rod Installation

Installing Ride Guide Steering Cable to the Outboard

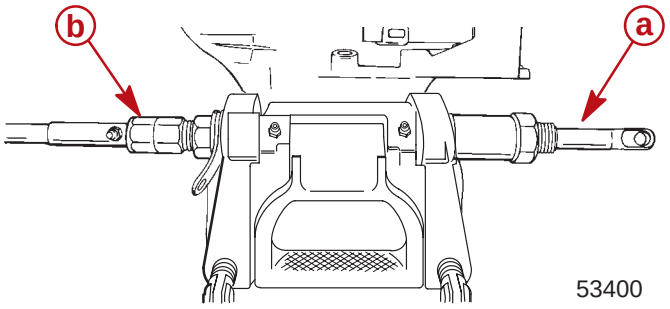
IMPORTANT: Before installing steering cable into tilt tube, lubricate entire cable end with 2-4-C with Teflon.

1. Lubricate the entire cable end.



95 2-4-C with Teflon

2. Insert steering cable end through outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut as shown. Tighten to specified torque.

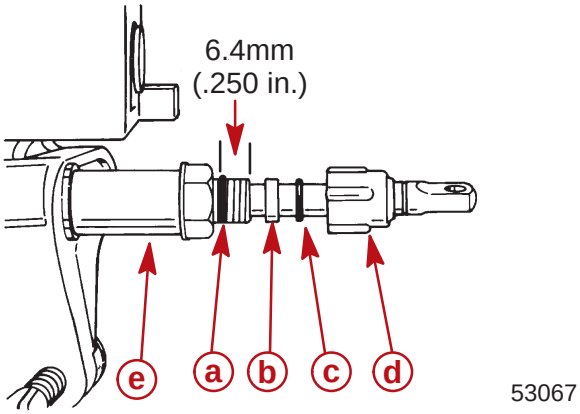


a - Cable end
b - Attaching nut

Steering Cable Attaching Nut Torque
47.5 Nm (35 lb-ft)

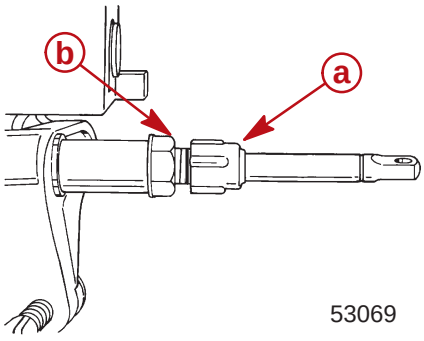
Steering Cable Seal

1. Place a mark on tilt tube 6.4 mm (.250 in.) from port end of tube. Slide plastic spacer, O-ring and cap over steering cable end, to tilt tube on engine.



a - Mark
b - Spacer
c - O-ring
d - Cap
e - Spacer

2. Thread cap up to the 6.4 mm (1/4 in.) mark.



a - Cap
b - 6.4 mm (.250 in.) mark

Steering Link Rod Installation

IMPORTANT: The steering link rod that connects the steering cable to the engine must be fastened using special self locking nuts. These locknuts must never be replaced with common nuts (non-locking) as they will work loose and vibrate off freeing the link rod to disengage.

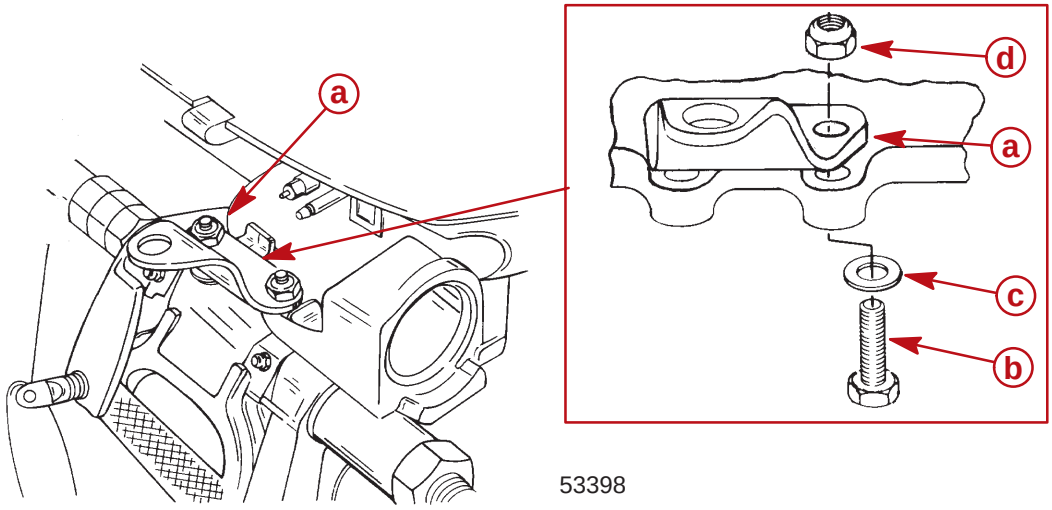
⚠ WARNING

Disengagement of a steering link rod can result in the boat taking a full, sudden, sharp turn. This potentially violent action can cause occupants to be thrown overboard exposing them to serious injury or death.

⚠ WARNING

After installation is complete (and before operating outboard), check that boat will turn right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering through full range (left and right) and at all tilt angles to assure interference-free movement.

1. Secure steering bracket to engine. Tighten nut to specified torque.

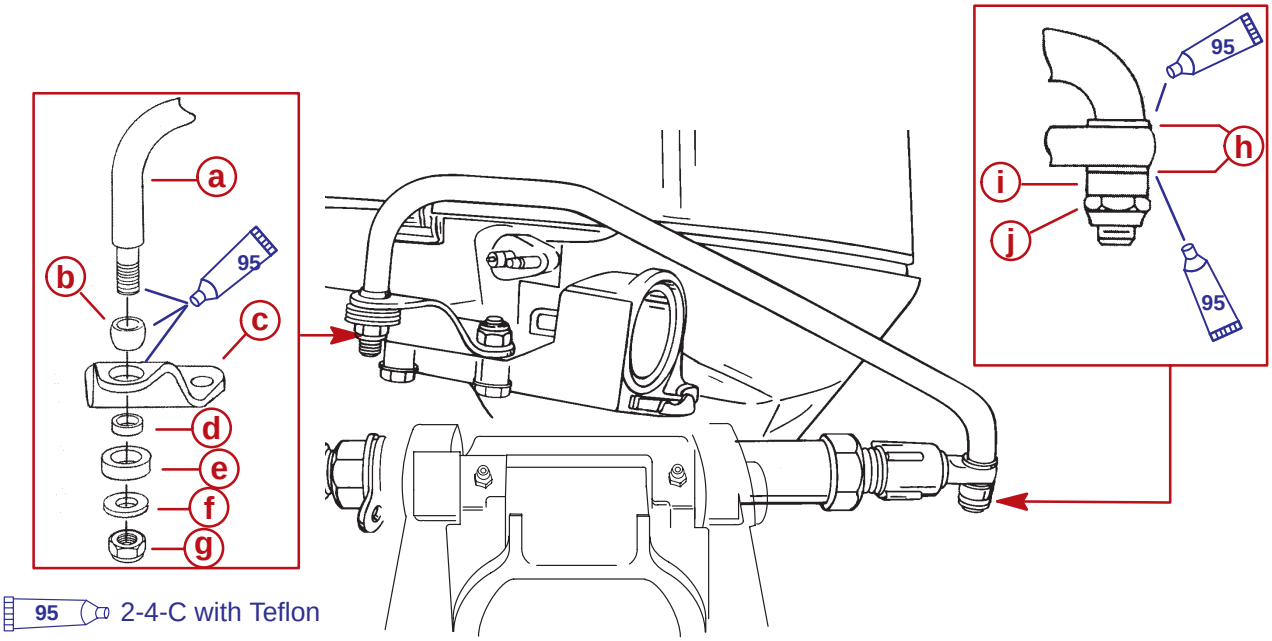


53398

a - Steering bracket
b - Bolt (2)
c - Flat washer (2)
d - Locknut (2)

Steering Bracket Nut Torque
15.8 Nm (140 lb-in.)

2. Secure steering link rod between engine steering bracket and steering cable end.



a - Steering link arm
b - Ball joint (flat end facing up)
c - Steering bracket
d - Spacer - 9.5 mm (3/8 in.)
e - Rubber spacer
f - Flat washer 20.6 mm (13/16 in.)
g - Locknut. Tighten to specified torque.
h - Flat washer [15.9 mm (5/8 in.)] (2)
i - Spacer
j - Locknut. Tighten until nut seats, then back off 1/4-turn

Locknut Torque
27 Nm (20 lb-ft)

Remote Control Installation

Refer to **Mercury Precision Parts/Quicksilver Accessory Guide** for appropriate electric or manual remote control. Use instructions provided with control for proper installation.

Shift and Throttle Cable Installation to the Outboard

IMPORTANT: Install control cables to remote control and mount control before attaching control cables to outboard.

Install throttle and shift cables to remote control and mount control as outlined in installation instructions which accompany the remote control.

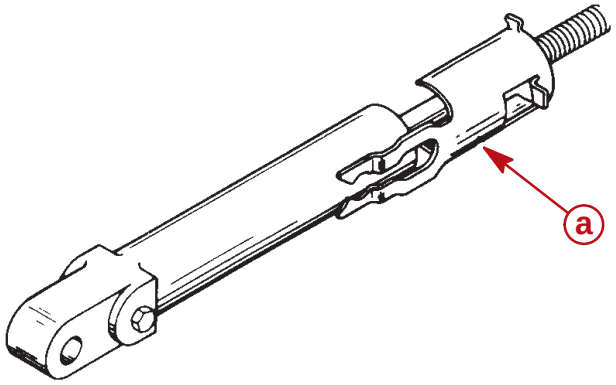
NOTE: *Attach shift cable to outboard first. Shift cable is the first cable to move when remote control handle is advanced from NEUTRAL position toward in-gear position.*

Refer to the **Mercury Precision Parts/Quicksilver Accessory Guide** to determine correct length of remote control cables.

IMPORTANT: Remote control cables must be the correct length. Sharp bends on too-short cables result in kinks. Too-long cables require unnecessary bends and/or loops. Both conditions place extra stress on the cables and control.

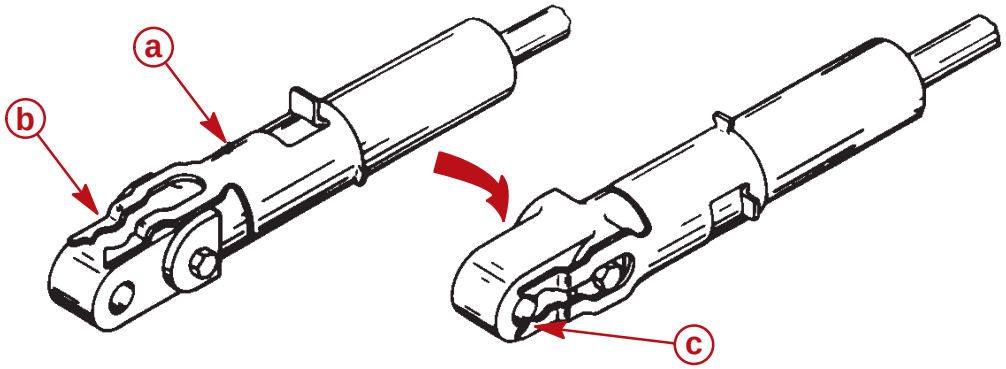
INSTALLING CABLE RETAINERS ON CABLES

1. Slip cable retainer over the threaded metal end of control cables.



a - Retainer

2. Push cable retainer onto control cables so that the pointed ends are on the top side of hole.
3. Rotate cable retainer 90° to position end of retainer over hole.

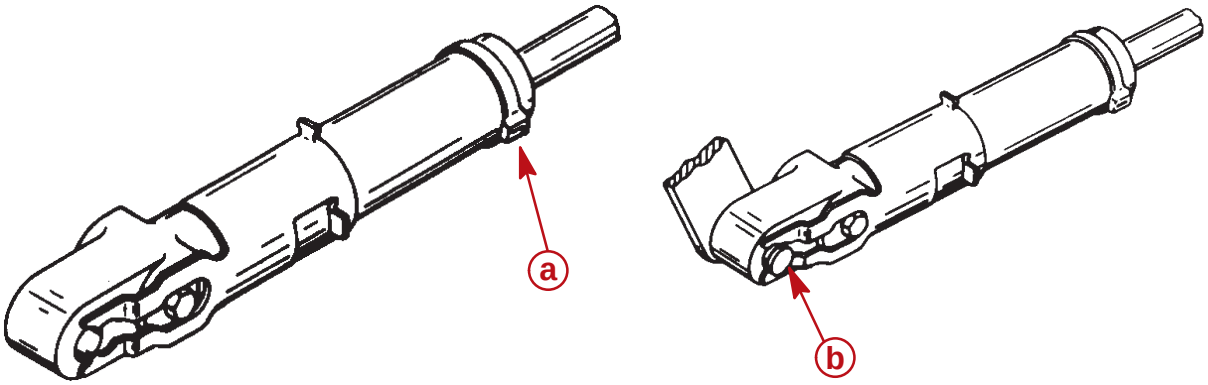


a - Retainer
b - Pointed ends
c - Hole

4. Install cable ties on control cables.

NOTE: *Cable ties will prevent retainers from slipping off cables whenever cables are removed from engine.*

5. Place end of control cables on anchor pins and lock in place with retainers.



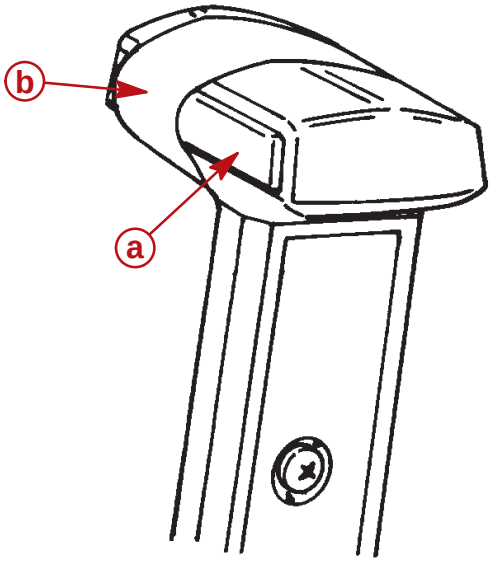
a - Cable tie
b - Pin

SHIFT CABLE INSTALLATION

1. If remote control has a NEUTRAL lock release, secure the release in the depressed position using a piece of tape. The true NEUTRAL detent can now be located.

⚠ WARNING

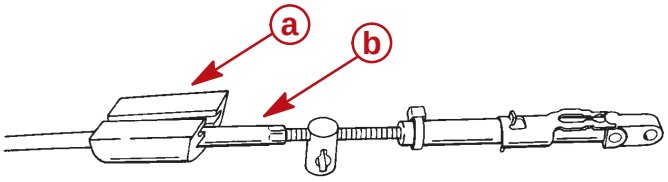
To avoid accidental starting which could result in personal injury, remove and isolate high tension spark leads BEFORE working near propeller.



53258

a - Neutral lock release
b - Tape

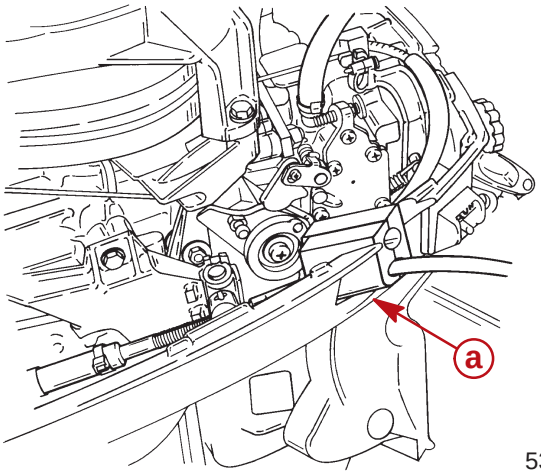
2. Wrap rubber control cable grommet around shift cable.



53212

a - Grommet
b - Cable

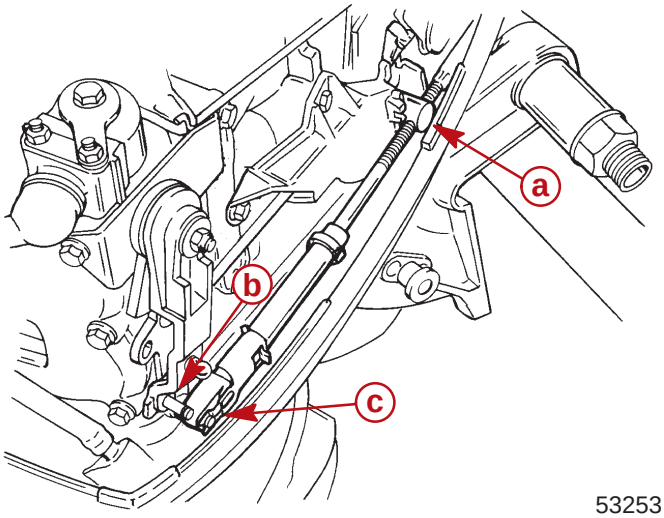
3. Push grommet with cable into opening in starboard bottom cowl.



53249

a - Grommet

4. Manually shift outboard into **neutral** position (propeller will rotate freely in both directions).
5. Adjust barrel on shift cable to attain the same distance between barrel and hole in end of shift cable as exists between barrel recess of control cable anchor bracket and shift lever pin.
6. Slip barrel into barrel recess. Place end of shift cable on shift lever pin and lock in place with cable retainer. Secure barrel after throttle cable is installed.



53253

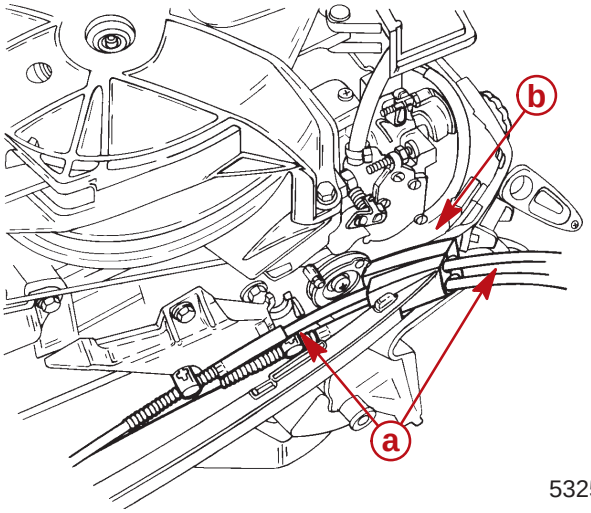
a - Barrel
b - Pin
c - Retainer

7. Check shift cable adjustment as follows:
   a. Shift remote control into **forward** gear. The propeller should not be able to rotate in a counterclockwise direction. If propeller does rotate counterclockwise, adjust barrel closer to end of cable and recheck.
   b. Shift remote control into **neutral**. Propeller should turn freely without drag. If not, adjust barrel away from end of cable and repeat steps a and b.
   c. While rotating propeller shaft, shift remote control into **reverse** gear. If propeller can be rotated, adjust barrel away from end of cable and repeat steps a through c.
   d. Shift remote control into **neutral**. Propeller should turn freely without drag. If not, adjust barrel closer to end of cable and repeat steps a through d.

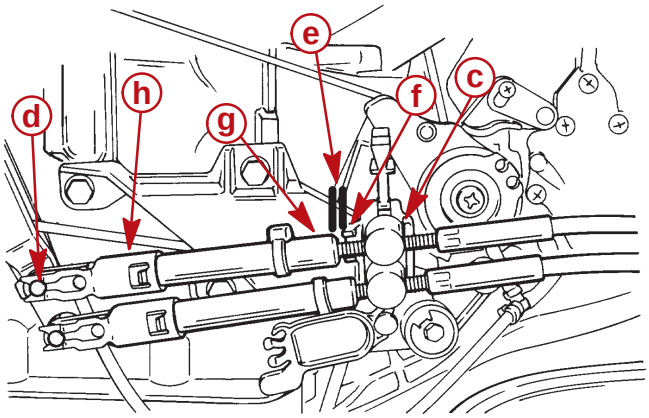
THROTTLE CABLE INSTALLATION

NOTE: *For easier installation of throttle cable into control cable grommet, apply a soap and water solution to top and inside of grommet.*

1. Install throttle cable into control cable grommet.
2. Move remote control handle **forward t**o wide open throttle position.
3. Slide barrel of throttle cable into barrel recess of control cable anchor bracket. Place end of cable on throttle lever pin.
4. With remote control in the wide open throttle position, a 1.6 mm (1/16 in.) gap must exist between guide of anchor bracket and control cable end. Adjust throttle barrel as required.
5. Secure throttle cable end to throttle lever pin with retainer.



53252



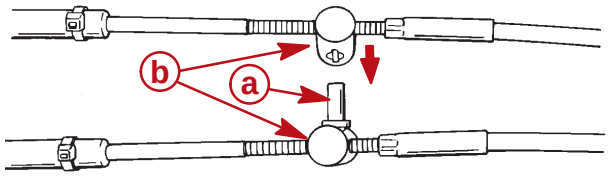
53254

a - Throttle cable
b - Grommet
c - Barrel
d - Throttle lever pin
e - 1.6mm (1/16 in.) gap
f - Guide
g - Cable end
h - Retainer

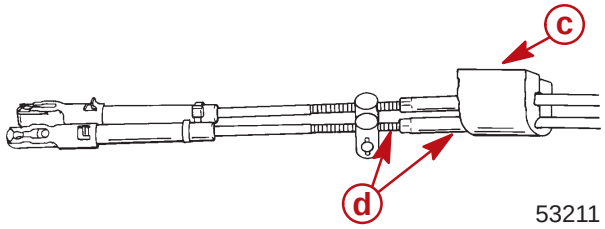
SPECIAL INSTRUCTIONS

On installations where control cables will frequently be removed and reinstalled after the initial installation (i.e. inflatable boats), a barrel retaining plug has been supplied as an aid for installation. Using this plug allows the control cables to installed as a set without further cable adjustment. Install barrel retaining plug as follows:

1. Without allowing barrels of control cables to rotate, remove cables with cable grommet from outboard.
2. Install barrel retainer plug between control cable barrels.
3. Wrap cable grommet around control cables.



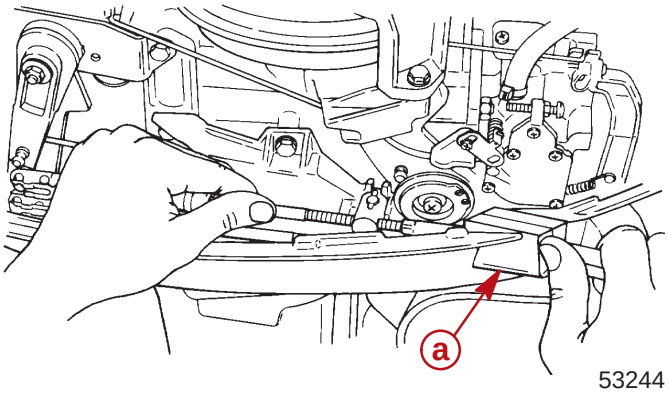
53230



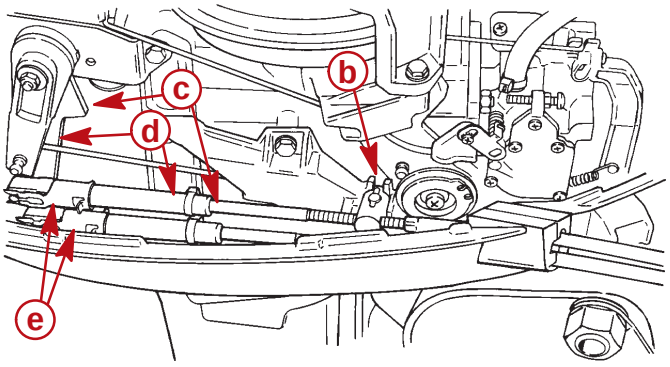
53211

a - Barrel retainer plug
b - Control cable barrels
c - Grommet
d - Control cables

4. Push grommet with control cables into opening in starboard bottom cowl.
5. Place remote control in **neutral** position.
6. Manually shift outboard into **neutral** position.
7. Slide control cable barrels into barrel recess of anchor bracket.
8. Place ends of control cables onto pins of shift/throttle levers and lock in place with cable retainers.



53244

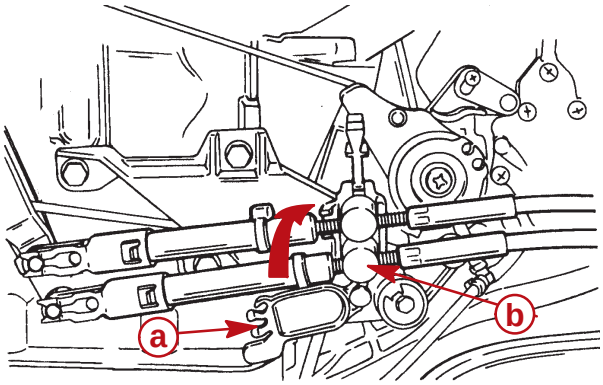


53243

a - Grommet
b - Control cable barrels (2)
c - Shift cable/lever
d - Throttle cable/lever
e - Cable retainers

SECURING CABLES TO ANCHOR BRACKET

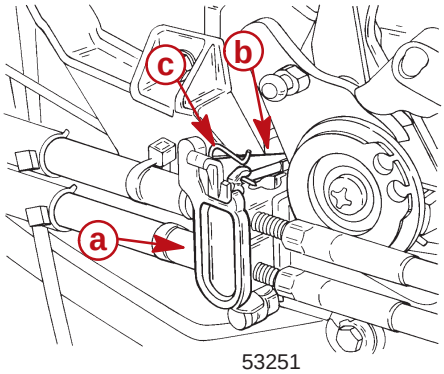
1. Position barrel retainer over barrels of control cables.



53254

a - Retainer
b - Barrels

2. Secure barrel retainer with latch. Latch must snap onto barrel retainer.
3. Align hole in latch with hooks of barrel retainer and secure with latch pin.

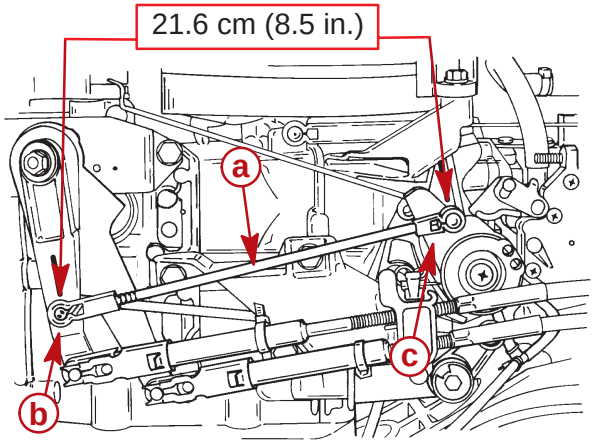


53251

a - Retainer
b - Latch
c - Pin

THROTTLE LINK ROD INSTALLATION

1. Adjust throttle link rod to a length of 21.6 cm (8.5 in.) as measured between ball joint centerlines.
2. Install throttle link rod between ball joint of throttle control lever and ball joint of actuating lever.

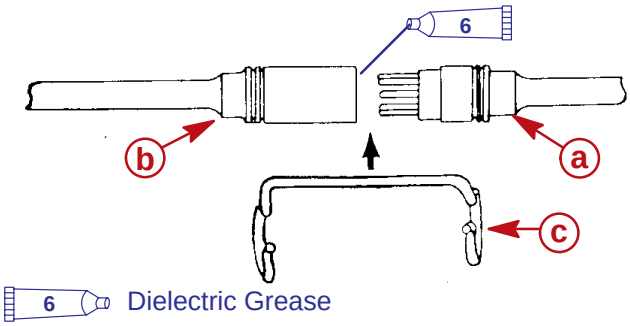


53236

a - Throttle link rod [21.6 cm (8.5 in.)]
b - Throttle control lever
c - Actuating lever

Remote Wiring Harness Connection to Engine

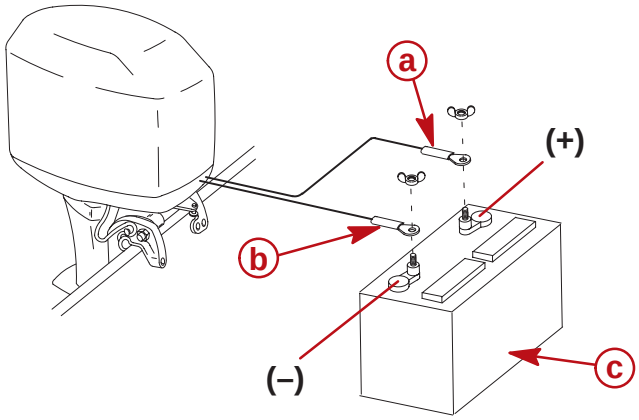
1. Apply Dielectric Grease inside the connection.
2. Plug the remote wiring connector into the outboard wiring harness connector. Secure the connection together with retainer, as shown.



a - Remote wiring connector
b - Outboard wiring harness connector
c - Retainer

Battery Cable Connections

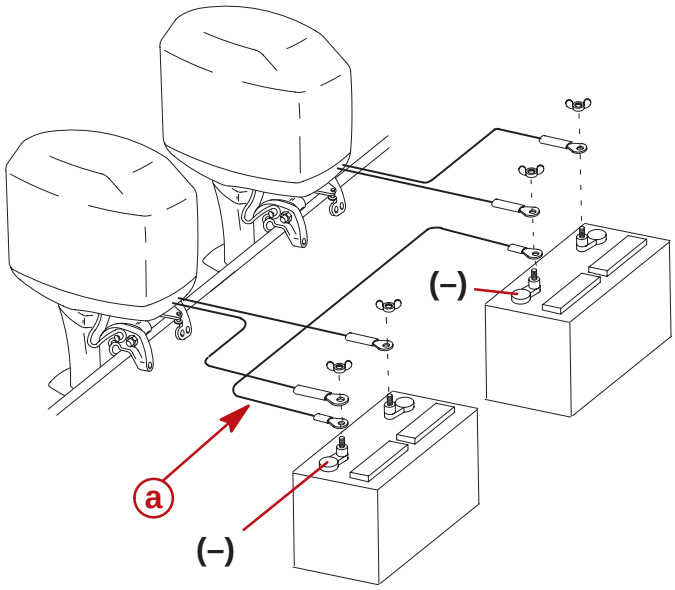
SINGLE OUTBOARD



a - Red sleeve (positive)
b - Black sleeve (negative)
c - Starting battery

DUAL OUTBOARD

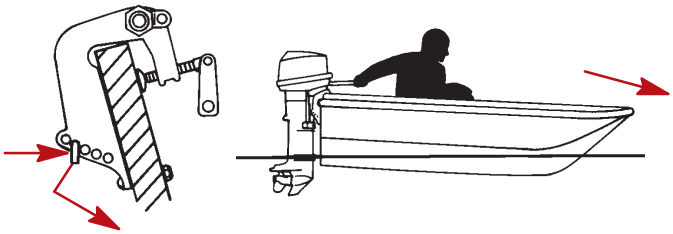
1. Connect a common ground cable (wire size same as engine battery cables) between negative terminals on starting batteries.



a - Ground cable (same wire size as engine battery cable) - connect between negative Terminals

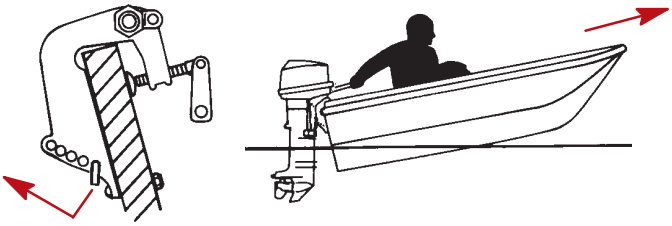
Tilt Pin Adjustment

Placing Tilt Pin in Lower Holes



1. Lower the bow.
2. Result in quicker planing off, especially with a heavy load or a stern heavy boat.
3. Generally improve the ride in choppy water.
4. Increase steering torque or pull to the right (with the normal right hand rotation propeller).
5. In excess, lower the bow of some boats to a point at which they begin to plow with their bow in the water while on plane. This can result in an unexpected turn in either direction called bow steering or over-steering if any turn is attempted or if a significant wave is encountered.

Placing Tilt Pin in Upper Holes



1. Lift the bow out of the water.
2. Generally increase top speed.
3. Increase clearance over submerged objects or a shallow bottom.
4. Increase steering torque or pull to the left at a normal installation height (with the normal right hand rotation propeller).
5. In excess, cause boat porpoising (bouncing) or propeller ventilation.

ELECTRICAL AND IGNITION

Section 2A – Ignition System

Table of Contents

Specifications 2A-1
Special Tools Required 2A-2
Electrical Components 2A-4
Description 2A-6
Test Procedures 2A-6
Ignition Troubleshooting (BLACK Stator) 2A-7
Ignition Troubleshooting (RED Stator) 2A-8
Ignition Components Removal and Installation 2A-9
Ignition Components Removal and Installation 2A-10

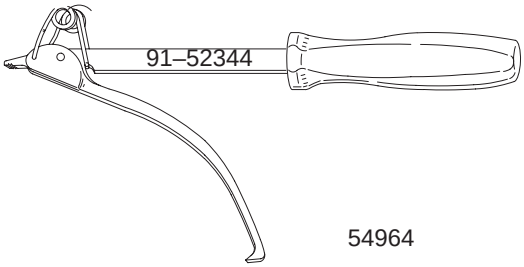
2 A

Specifications

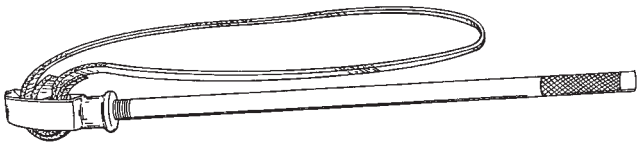
IGNITION SYSTEM **Readings taken @ 68°F (20°C).**	**BLACK Stator**	
	Stator High Speed Winding	120 - 180 Ω (BLACK/WHITE- GROUND)
	Stator Low Speed Winding	3000 - 3600 Ω (BLACK/YELLOW - GROUND)
		3100 – 3700 Ω (BLACK/YELLOW - BLACK/WHITE)
	Ignition Coil Resistance:	
	Primary	0.02 - 0.04 Ω
	Secondary	8000 - 11000 Ω
	Trigger	6500 - 8500 Ω
	RED Stator	
	Stator Capacitor Charging Winding	370 – 445 Ω (GREEN/WHITE - WHITE/ GROUND)
	Ignition Coil Resistance:	
	Primary	0.02 - 0.04 Ω
	Secondary	8000 - 11000 Ω
	Trigger	6500 - 8500 Ω

Special Tools Required

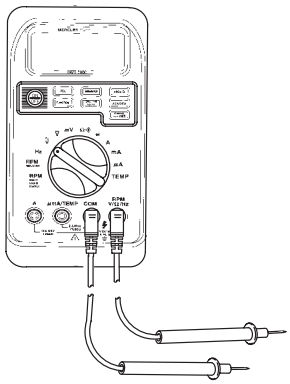
1. Flywheel Holder 91-52344



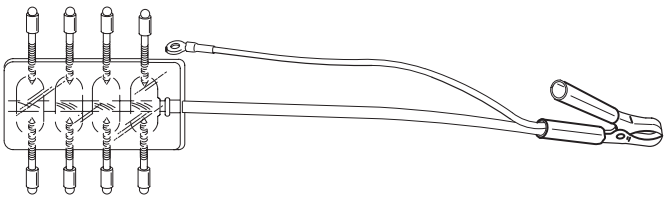
2. Flywheel Holder 91-24937A1



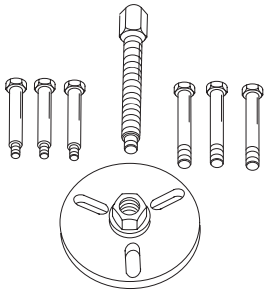
3. DMT 2000 Digital Multimeter 91-854009A1



4. Spark Gap Board 91-850439

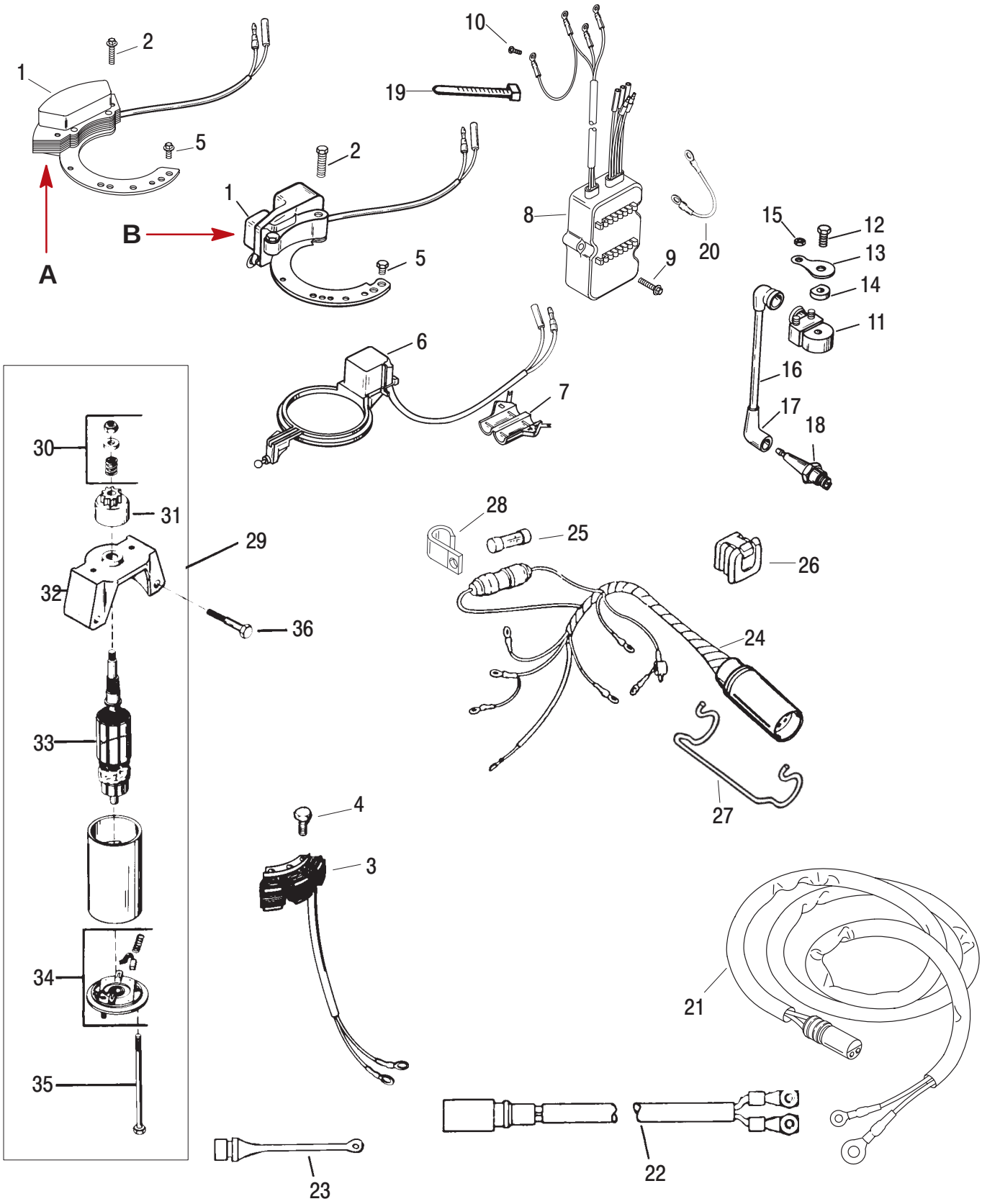


5. Flywheel Puller 91-83164M



Notes:

Electrical Components



A – RED Stator

B – BLACK Stator

Electrical Components (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	STATOR ASSEMBLY			
2	2	SCREW (M5 x 30)	40		4.5
3	1	STATOR AUXILIARY **(ELECTRIC/ALTERNATOR MODELS)**			
4	3	SCREW (M5 x 30)	40		4.5
5	1	SCREW (M5 x 10) **(MANUAL)**	40		4.5
6	1	TRIGGER ASSEMBLY			
7	1	CLIP–trigger lead			
8	1	SWITCH BOX			
9	3	SCREW–switch box to block (M5 x 35)	Drive Tight		
10	2	SCREW–ground wire (10-16 x 1/2)	Drive Tight		
11	2	IGNITION COIL ASSEMBLY			
12	2	SCREW–ignition coil	35		3.9
13	2	TAB WASHER			
14	2	BUSHING–coil			
15	4	NUT–coil terminal	20		2.2
16	1	LEAD ASSEMBLY–high tension			
17	2	BOOT ASSEMBLY–spark plug			
18	2	SPARK PLUG (NGK#BP8H-N-10) **6/8**			
	2	SPARK PLUG (NGK#BPZ-8H-N-10)			
	2	SPARK PLUG (NGK#BP8HS-15) **9.9/15**			
	2	SPARK PLUG (NGK#BPZ8HS-15)			
19	AR	STA-STRAP **(8 IN.)**			
	AR	STA-STRAP **(5-1/2 IN.)**			
20	1	CABLE–grounding			
21	1	HARNESS (62 IN. - BLACK/RED)			
22	1	HARNESS (20 IN. - BLACK/RED) **SAILPOWER/SAILMATE**			
23	1	PLUG			
24	1	ENGINE WIRING HARNESS			
25	1	FUSE			
26	1	RETAINER **REMOTE CONTROL**			
27	1	RETAINER			
28	1	J-CLAMP			
29	1	STARTER MOTOR			
30	1	DRIVE KIT			
31	1	DRIVE			
32	1	END CAP			
33	1	ARMATURE			
34	1	END CAP			
35	2	THRU BOLT			
36	2	SCREW (M8 x 55)			

Description

The ignition system is an alternator driven capacitor discharge system. Major components of the ignition system are the flywheel, stator, trigger coil, switch box, 2 ignition coils and 2 spark plugs.

The flywheel has permanent magnets mounted in both the outer rim and the center hub.

The BLACK stator assembly is mounted below the flywheel and has a low speed (LS) and a high speed (HS) capacitor charging coil. Low speed coil provides primary voltage to the switch box from idle to approximately 2500 RPM. The high speed coil provides primary voltage from 2000 RPM to the maximum RPM the outboard is capable of achieving.

The RED stator assembly is mounted below the flywheel and has only one capacitor charging coil.

As the flywheel rotates, the magnets mounted in the flywheel outer rim pass the charging coils creating voltage. This voltage is rectified to DC and charges the capacitor located in the switch box.

As the flywheel continues to rotate, the magnets in the center hub pass the trigger coil creating voltage pulses. These pulses turn on one of the two electronic switches (SCR) in the switch box. A positive voltage pulse turns on the SCR switch associated with cylinder #1; a negative voltage pulse turns on the SCR switch associated with cylinder #2.

The SCR switch discharges the stored capacitor voltage into the primary side of the respective ignition coil. The ignition coil multiplies this voltage to a value high enough to jump the spark plug gap – 34000 volts for standard coils; 40000 volts for high energy coils.

This sequence occurs once per engine revolution for each cylinder.

Spark timing is changed (advanced/retarded) by rotating the trigger coil on mechanically advanced models which changes the trigger coil position in relation to the magnets in the center hub of the flywheel.

Spark timing on electronically advanced models is controlled internally by the switch box with a fixed trigger.

The stop switch (or ignition switch) shorts the output of the stator to ground to stop the engine on all models.

Test Procedures

⚠ WARNING

When testing or servicing the outboard ignition system, high voltage is present. Be extremely cautious. DO NOT touch or disconnect any ignition components while engine is running or while battery cables are connected on electric start models.

It is recommended that the switch box and ignition coils be tested with a Quicksilver Multi-Meter/DVA, or a voltmeter capable of measuring 400 volts DC or higher, in conjunction with Quicksilver Direct Voltage Adaptor.

All other components can be tested with an ohmmeter.

Before troubleshooting the ignition system, check the following:

1. On electric models, verify that the electric harness and ignition switch are not the source of the problem. Check that plug-in connectors are fully engaged and that plug terminals are free of corrosion.
2. Verify that wire connections are tight and free of corrosion.
3. Inspect all electrical components that are grounded directly to the engine and all ground wires that they are properly grounded to engine.
4. Inspect for disconnected wires and short and open circuits.

Ignition Troubleshooting (BLACK Stator)

TOOL : MULTIMETER/DVA

Tested Part	Multimeter Wires	Connected To	Scale	Resistance (ohms)
Stator (BLACK/YELLOW and BLACK/WHITE wires disconnected from switch box)	RED BLACK	BLACK/WHITE GROUND	R x 1	120 - 180
	RED BLACK	BLACK/YELLOW GROUND	R x 100	32 - 38
	RED BLACK	BLACK/YELLOW BLACK/WHITE	R x 100	31 - 37
Trigger (BROWN/YELLOW and BROWN/WHITE wires disconnected from switch box)	RED BLACK	BROWN/YELLOW BROWN/WHITE	R x 100	6.5 - 8.5

Tested Part	Multimeter	Connected To	Scale	Resistance (ohms)
Ignition Coils (all wires disconnected)	RED BLACK	+ Terminal – Terminal	R x 1	0.02 - 0.04
	RED BLACK	Spark Plug Tower – Terminal	R x 1000	8 - 11

Tested Part	Multimeter Wires	Connected To	Selector Position	Reading At 300 - 1000 RPM	Reading At 1000 - 4000 RPM
Switch Box Primary Coil	RED BLACK	– Terminal + Terminal	400 VDC	125 -260	200 - 360
Switch Box Stop Circuit Stator Low Speed	RED BLACK	GROUND BLACK/YELLOW	400 VDC	150 - 300	250 - 360
Stator High Speed	RED BLACK	GROUND BLACK/WHITE	400 VDC	10 - 75	50 - 300

NOTE: *Copper is an excellent conductor, but resistance may notably vary between low and high temperature. Therefore, reasonable differences can be accepted between resistance readings and specifications.*

Ignition Troubleshooting (RED Stator)

TOOL : MULTIMETER/DVA

Tested Part	Multimeter Wires	Connected To	Scale	Resistance (ohms)
Stator (GREEN/WHITE and WHITE/GREEN wires disconnected from switch boxes)	RED BLACK	GREEN/WHITE WHITE/GREEN	R x 1	370 - 445
Trigger (BROWN/YELLOW and BROWN/WHITE wires disconnected from switch boxes)	RED BLACK	BROWN/YELLOW BROWN/WHITE	R x 100	6.5 - 8.5

Tested Part	Multimeter	Connected To	Scale	Resistance (ohms)
Ignition Coils (all wires disconnected)	RED BLACK	+ Terminal – Terminal	R x 1	0.02 - 0.04
	RED BLACK	Spark Plug Tower – Terminal	R x 1000	8 - 11

Tested Part	Multimeter Wires	Connected To	Selector Position	Reading At 300 - 1000 RPM	Reading At 1000 - 4000 RPM
Switch Box Primary Coil	RED BLACK	– Terminal + Terminal	400 VDC	125 - 320	200 - 320
Switch Box Stop Circuit	RED BLACK	BLACK/YELLOW GROUND	400 VDC	150 - 330	250 - 330
Stator Voltage	RED BLACK	GREEN/WHITE GROUND	400 VDC	150 - 330	250 - 330
	RED BLACK	WHITE/GREEN GROUND	400 VDC	150 - 330	250 - 330

NOTE: *Copper is an excellent conductor, but resistance may notably vary between low and high temperature. Therefore, reasonable differences can be accepted between resistance readings and specifications.*

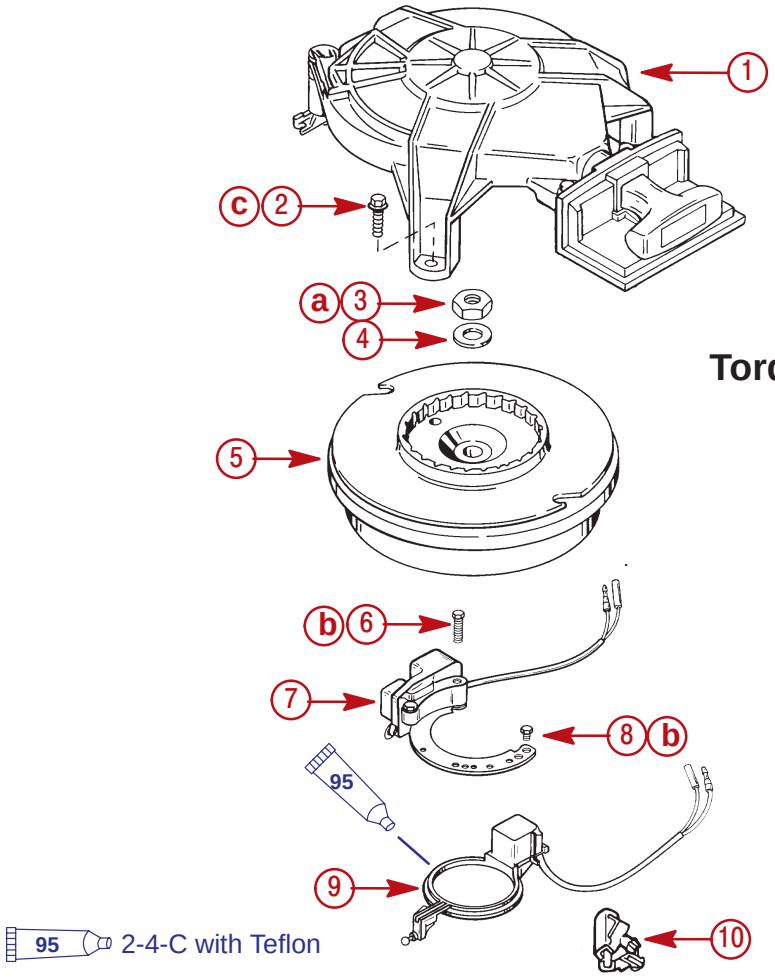
Ignition Components Removal and Installation

⚠ CAUTION

Do not strike flywheel with a hard object as flywheel damage could occur. Inspect flywheel magnets for clinging debris before installation.

⚠ WARNING

Engine could possibly start when turning flywheel during removal and installation. Disconnect (and isolate) spark plug leads.



Torque Specifications

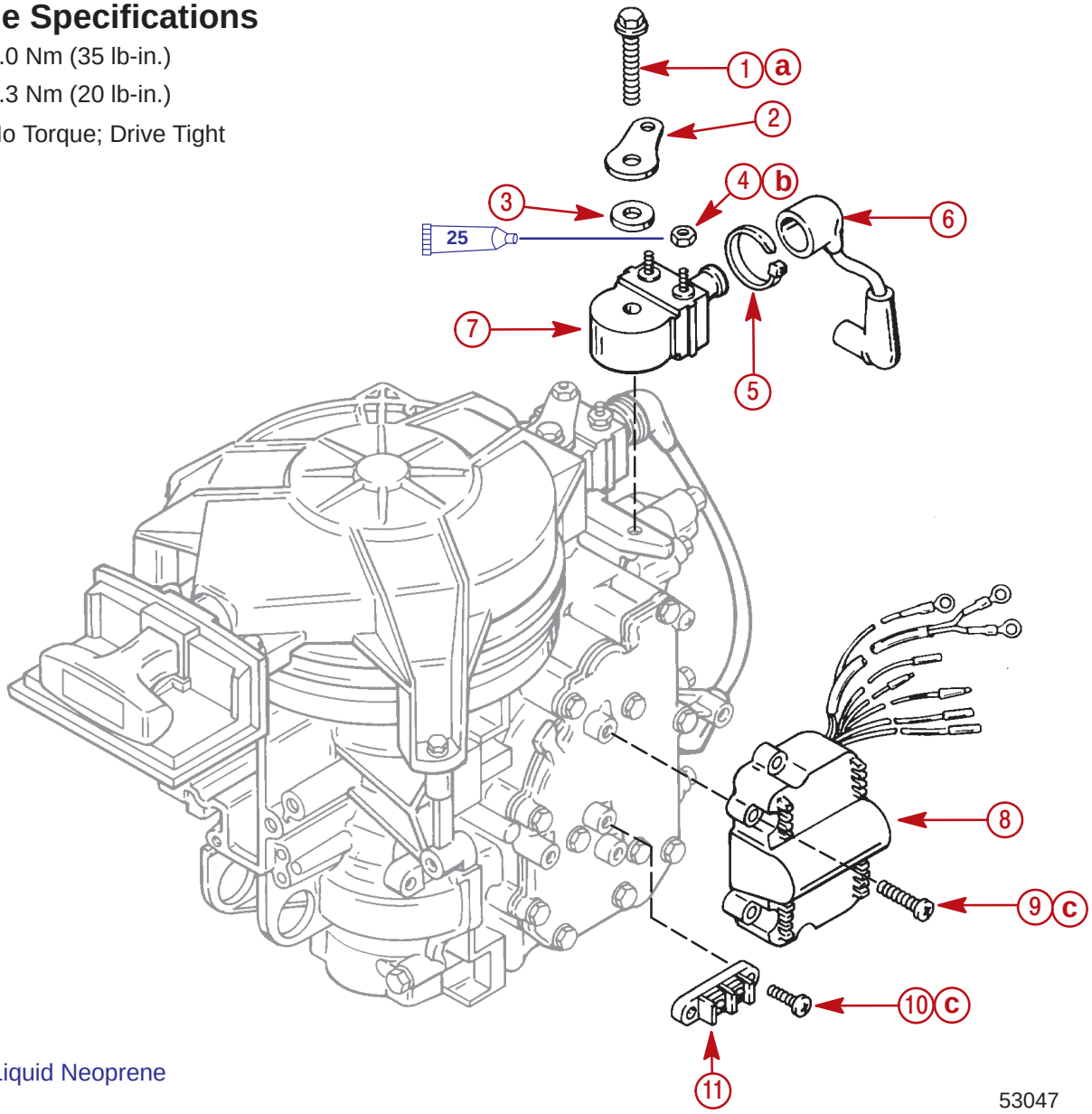
- (a) 67.8 Nm (50 lb-ft)
- (b) 4.5 Nm (40 lb-in.)
- (c) 7.9 Nm (70 lb-in.)

1 - Recoil assembly
2 - Bolt (3)
3 - Flywheel nut
4 - Washer
5 - Flywheel
6 - Screw (2)
7 - Stator
8 - Screw (manual)
9 - Trigger
10 - Retainer (trigger)

Ignition Components Removal and Installation (continued)

Torque Specifications

- (a) 4.0 Nm (35 lb-in.)
- (b) 2.3 Nm (20 lb-in.)
- (c) No Torque; Drive Tight



1 - Bolt (2)
2 - Retainer (2)
3 - Washer (2)
4 - Nut (4)
5 - Sta-strap (2)
6 - Spark plug lead
7 - Ignition coil
8 - Switch box
9 - Screw (3)
10 - Screw (2)
11 - Terminal block

ELECTRICAL AND IGNITION

Section 2B – Charging and Starting System

Table of Contents

Specifications 2B-1
Recommended Battery 2B-2
Battery 2B-2
Precautions 2B-2
Operating Engine Without Battery 2B-2
Battery Charging System Troubleshooting 2B-3
Battery Charging System 2B-3
(1998 And Prior) 2B-3
Alternator Amperes Output 1998 And Prior (Stator - 8 Pole/4 Pulse) 2B-4
Alternator Test (1998 And Prior) 2B-4
Rectifier Test (1998 And Prior) 2B-4
(1999 And Newer) 2B-6
Alternator Amperes Output 1999 And Newer (Stator - 10 Pole/5 Pulse) 2B-6
Tachometer Module Static Test 2B-7
Tachometer Module Running or Cranking Test 2B-9
Rectifier/Regulator (P/N 853358T1) Diode Test 2B-10
Digital Meter (DMT 2000 or Equivalent) . 2B-10
Analog Meter 2B-12
Starting System 2B-13
Description 2B-13
Troubleshooting the Starting Circuit 2B-13
Starting Circuit Troubleshooting Flow Chart . 2B-14
COMMANDER 2000 Key Switch Test . . . 2B-16
Emergency Stop Switch (Lanyard Type) . 2B-17
Push Button Stop Switch 2B-17
Electrical Component Removal and Installation 2B-18
Starter Motor 2B-19
Disassembly 2B-19
Cleaning and Inspection 2B-20
Testing Motor Armature 2B-20
Starter Motor Reassembly 2B-21
Starter Solenoid Test 2B-23
Flywheel Ring Gear 2B-24
Installation 2B-24
Neutral Start Switch (Electric Start Tiller Handle Shift Models) . . . 2B-24
Tiller Handle Start Button 2B-25
Choke Solenoid 2B-26
Installation 2B-26
Battery Cables/Engine Wiring Harness (Remote Electric Start Models) 2B-27
Battery Cables (Tiller Handle Push Button Electric Start Models) 2B-29
Installation 2B-29
Plug Harness (Battery Charging Kit) 2B-30
Installation 2B-30
Emergency Stop Switch (Lanyard Type) 2B-30
Installation 2B-30

2 B

Specifications

STARTING SYSTEM	**Manual Start** **Electric Start** **Starter Draw (Under Load)** **(No Load)**	Recoil 12 Volt 55 Amperes 15 Amperes
CHARGING SYSTEM	**Alternator Output** **2 Magnet Flywheel** **(8 Pole)(4 Pulses)** **4 Magnet Flywheel** **(10 Pole)(5 Pulses)**	 4 Amp. (48 Watt) @ 6000 RPM 6 amp (72 Watt) @ 6000 RPM
BATTERY	**Battery Rating**	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)

Recommended Battery

A 12 volt battery with a Marine Cranking Amperage rating minimum of 465 amperes or a Cold Cranking Amperage of 400.

Battery

Precautions

When charging batteries, an explosive gas mixture forms in each cell. A portion of this gas escapes through holes in vent plugs and may form an explosive atmosphere around battery if ventilation is poor. This explosive gas may remain in or around battery for several hours after it has been charged. Sparks or flames can ignite this gas and cause an internal explosion which may shatter the battery.

The following precautions should be observed to prevent an explosion.

1. DO NOT smoke near batteries being charged or which have been charged very recently.
2. DO NOT break live circuits at terminals of batteries because a spark usually occurs at the point where a live circuit is broken. Always be careful when connecting or disconnecting cable clamps on chargers. Poor connections are a common cause of electrical arcs which cause explosions.
3. DO NOT reverse polarity of battery cables on battery terminals.

⚠ CAUTION

If battery acid comes into contact with skin or eyes, wash skin immediately with a mild soap. Flush eyes with water immediately and consult a physician.

Operating Engine Without Battery

In an emergency, engines equipped with an alternator can be started and operated without a battery, if the **WARNING** below is followed.

⚠ WARNING

Before operating engine with battery leads disconnected from battery, disconnect stator leads from rectifier and insulate leads from touching ground.

Battery Charging System Troubleshooting

A fault in the battery charging system usually will cause the battery to become undercharged. Check battery electrolyte level, and charge battery. See **Electrolyte Level**, and **Charging a Discharged Battery**.

If battery will NOT accept a satisfactory charge, replace battery.

If battery accepts a satisfactory charge, determine the cause of the charging system problem as follows.

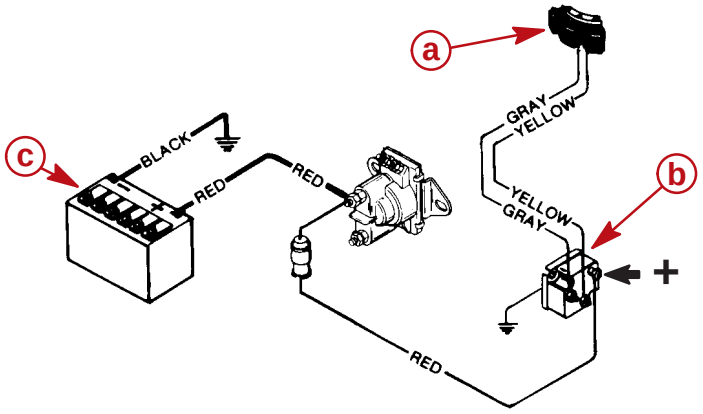
1. Check for correct battery polarity [RED cable to POSITIVE (+) battery terminal]. If polarity was incorrect, check for damaged rectifier. Refer to RECTIFIER, RECTIFIER/REGULATOR TEST.
2. Check for loose or corroded battery connections.
3. Visually inspect wiring between stator and battery for cuts, chafing; and disconnected, loose or corroded connection.
4. Excessive electrical load (too many accessories) will cause battery to run down.

If visual inspection determines that battery connections and wiring are OK, perform the following stator and rectifier tests.

Battery Charging System

(1998 And Prior)

The battery charging system components are the alternator, rectifier and battery. Alternating current flows to the rectifier which changes alternating current (AC) current to direct current (DC) for charging the battery.



a - Alternator
b - Rectifier
c - Battery

The charging system may be damaged by:

1. Reversed battery cables.
2. Running the engine with battery cables disconnected and alternator leads connected to rectifier.
3. An open circuit, such as a broken wire or loose connection.

Alternator Amperes Output 1998 And Prior (Stator - 8 Pole/4 Pulse)

Amperage output can be measured by installing a amp meter a (10 amp minimum) in series between the rectifier and the battery or by clamping an inductive type amp meter (10 amp minimum) over the RED output lead from the rectifier to the battery.

NOTE: *Acceptable alternator amperage output should be within ± 10% of the amperes listed below.*

RPM	AMPERES
Idle	0
1000	0
2000	.9
3000	2.5
4000	3.5
5000	4.0
6000	4.3

Alternator Test (1998 And Prior)

NOTE: *Alternator can be tested without removing from engine.*

1. Disconnect GRAY and YELLOW alternator leads from terminals on either rectifier, voltage regulator or isolator block.
2. Use an ohmmeter and perform tests as shown in following chart.
3. If meter readings are other than specified, replace alternator assembly.

Test Leads	Resistance	Scale
RED to YELLOW BLACK to GRAY	0.65*	R x 1
RED to either GRAY or YELLOW BLACK to GROUND	NO CONTINUITY	R x 1000

NOTE: *DC resistance of these windings generally is less than 1 ohm. A reading that resembles a short is acceptable.*

Rectifier Test (1998 And Prior)

⚠ WARNING

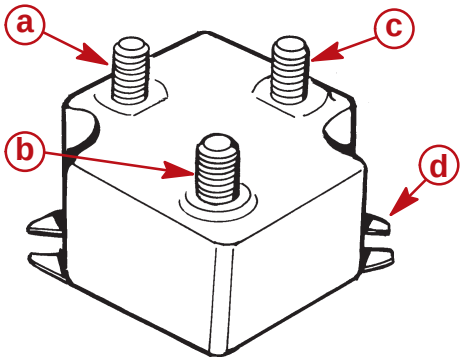
Disconnect battery leads from battery before testing rectifier.

NOTE: *Rectifier can be tested without removing from engine.*

1. Disconnect all wires from terminals on rectifier.
2. Use an ohmmeter (R x 1000 scale) and perform the following test. Refer to drawing for rectifier terminal identification.

Connect red meter lead to ground (d), black lead alternately to terminals (a) and (c).

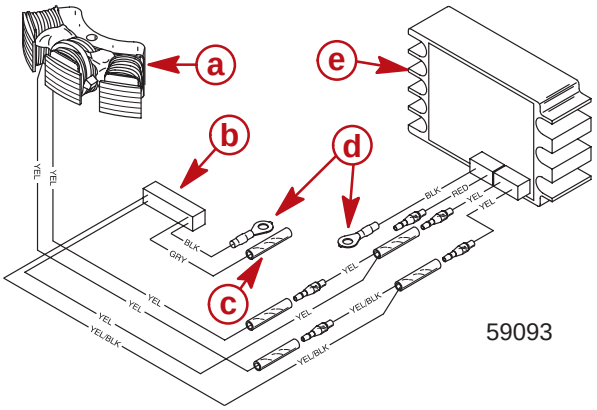
- Continuity Indicated
  Connect black meter lead to ground (d), red lead alternately to terminals (a) and (c).
  - No Continuity Indicated
    Connect black meter lead to terminal (b), red lead alternately to terminals (a) and (c).
    - Continuity Indicated
      Connect red meter lead to terminal (b), black lead alternately to terminals (a) and (c).
      - No Continuity Indicated. Rectifier tests O.K.
      - Continuity Indicated. Replace Rectifier.
    - No Continuity Indicated. Replace Rectifier.
  - Continuity Indicated. Replace Rectifier.
- No Continuity Indicated
  Connect black meter lead to ground (d), red lead alternately to terminals (a) and (c).
  - No Continuity Indicated. Replace Rectifier.
  - Continuity Indicated
    Connect black meter lead to terminal (b), red lead alternately to terminals (a) and (c).
    - Continuity Indicated. Replace Rectifier.
    - No Continuity Indicated
      Connect red meter lead to terminal (b), black lead alternately to terminals (a) and (c).
      - No Continuity Indicated. Replace Rectifier.
      - Continuity Indicated. Rectifier Tests O.K.



07300

(1999 And Newer)

The battery charging system components are the alternator, rectifier/regulator and the battery. Alternating current (generated in the alternator/stator coils) flows to the rectifier/regulator, which changes the alernating current ot direct current for charging the battery.



a - Alternator
b - Tachometer module
c - Tachometer lead
d - Ground leads
e - Rectifier/Regulator

The charging system may be damaged by:

a. Reversed battery cables.

b. Running the engine with battery cables disconnected and alternator leads connected to rectifier.

c. An open circuit, such as a broken wire or loose connection.

Alternator Amperes Output 1999 And Newer (Stator - 10 Pole/5 Pulse)

Amperage output can be measured by installing a amp meter (10 amp minimum) in series between the rectifier and the battery or by clamping an inductive type amp meter (10 amp minimum) over the RED output lead from the rectifier to the battery.

NOTE: *Acceptable alternator amperage output should be within ± 10% of the amperes listed below.*

RPM	AMPERES
Idle	0
1000	0.75
2000	3.5
3000	4.5
4000	5.0
5000	5.5
6000	6.0

Test Leads	Resistance	Scale
RED to YELLOW, BLACK to YELLOW	0.5*	R x 1
RED to either YELLOW, BLACK to GROUND	NO CONTINUITY	R x 1000

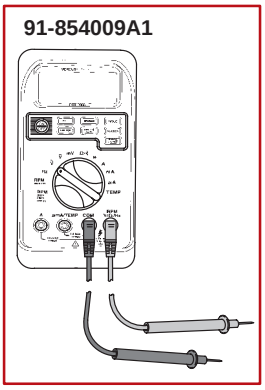
*DC resistance of these windings generally is less than 1 ohm. A reading that resembles a short is acceptable.

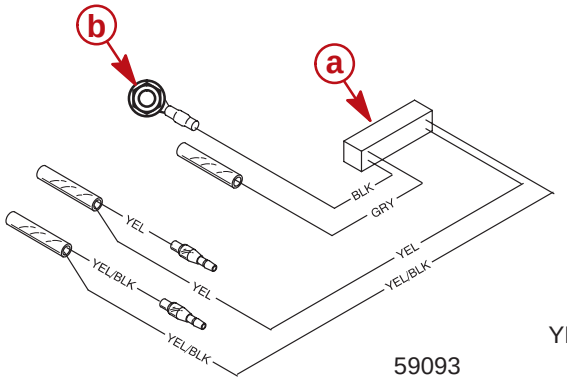
Tachometer Module Static Test

1. Disconnect GRAY, YELLOW, and YELLOW/BLACK tachometer module leads.
2. Set meter to ⊣◀.

NOTE: ⊣◀ *uses the batteryvoltage within the meter.*

3. Connect the multi-meter black lead to engine ground or BLACK harness wire. Connect the REDmulti-meter lead to the GRAY tachometer module engine bullet connector.
4. Measure voltage.





YEL = Yellow
BLK = Black
GRY = Gray
YEL/BLK = Yellow with Black Stripe

a - Tachometer module
b - Engine ground

METER TEST LEADS		METER SCALE	READING
RED	BLACK	**DIODE**	**Open, OUCH, or OL**
TACHOMETER MODULE LEADS			
GRAY	BLACK OR GROUND		

5. Connect the multi-meter RED lead to engine ground or BLACK harness wire. Connect the BLACK multi-meter lead to the GRAY tachometer module bullet connector.
6. Measure voltage.

METER TEST LEADS		METER SCALE	READING (V)
RED	BLACK	**DIODE**	**0.5 - 0.9 Volts**
TACHOMETER MODULE LEADS			
BLACK OR GROUND	GRAY		

7. Set meter to Ω.
8. Measure resistance.

METER TEST LEADS		METER SCALE	READING (Ω)
RED	BLACK	Ω	**4 - 8 Mega Ohms**
TACHOMETER MODULE LEADS			
BLACK OR GROUND	GRAY		

9. Connect GRAY, YELLOW, and YELLOW/BLACK tachometer module leads to engine harness.

10. Measure resistance.

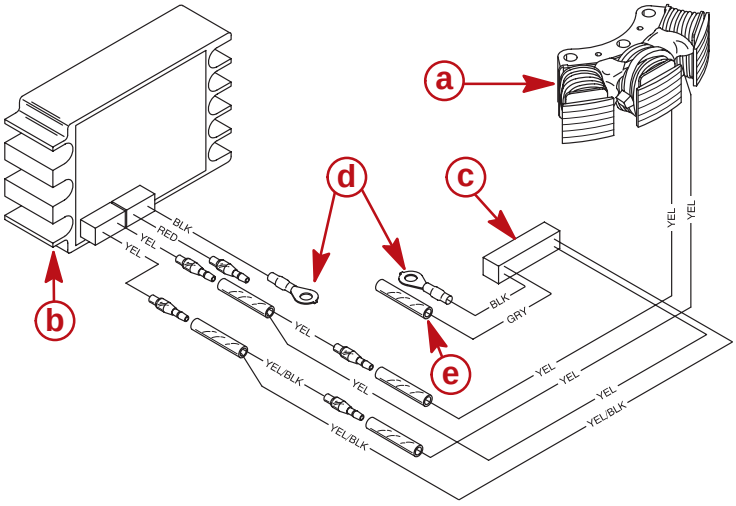
METER TEST LEADS		METER SCALE	READING (Ω)
RED	BLACK	Ω	**1 - 3 Mega Ohms**
TACHOMETER MODULE LEADS			
BLACK OR GROUND	GRAY		

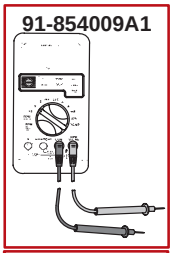
11. Connect the multi-meter RED lead to the YELLOW tachometer module wire. Connect the BLACK multi-meter lead to engine ground or to the BLACK tachometer module bullet connector.

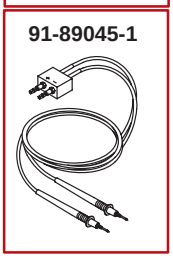
METER TEST LEADS		METER SCALE	READING (Ω)
RED	BLACK	Ω	**5.5 - 8 k Ohms**
TACHOMETER MODULE LEADS			
YELLOW	BLACK OR GROUND		

Tachometer Module Running or Cranking Test

OUTPUT VOLTAGE TEST







59093

a - Alternator, stator
b - Voltage regulator/rectifier
c - Tachometer module
d - Engine ground leads
e - Gray tachometer lead

1. Disconnect the GRAY tachometer lead.
2. Set meter to Voltage scale.
3. Connect Direct Voltage Adapter to DMT 2000 multi-meter. Connect the multi-meter RED lead to the GRAY tachometer module wire. Connect the BLACK multi-meter lead to engine ground or to the BLACK tachometor module bullet connector.
4. Crank or start engine.
5. Measure voltage.

METER TEST LEADS		METER SCALE	READING
RED	BLACK	V	**9 - 14 Volts**
TACHOMETER MODULE LEAD			
GRAY	BLACK OR GROUND		

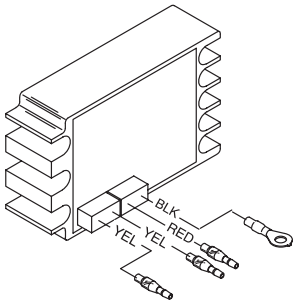
Rectifier/Regulator (P/N 853358T1) Diode Test

⚠ WARNING

Disconnect battery leads from battery before testing rectifier.

Digital Meter (DMT 2000 or Equivalent)

NOTE:*Voltage regulator/rectifier specifications are given for informational purposes only. Use the appropriate troubleshooting techniques previously mentioned to find the faulty component in the charging system.*



BLK = Black
RED = Red
YEL = Yellow

1. Set meter to Ω.
2. Connect BLACK (–) meter lead to regulator case.
3. Connect RED (+) meter lead to BLACK lead.

Resistance Specification
0.0 OHMS

4. Connect BLACK (–) meter lead to regulator case.
5. Connect RED (+) meter lead to RED lead.

Resistance Specification
4.28 K OHMS

RESISTANCE TEST - SCR

1. Set meter to Ω.
2. Connect RED (+) meter lead to regulator case.
3. Connect BLACK (–) meter lead to either YELLOW regulator lead. Test.
4. Connect BLACK (–) meter lead to YELLOW/BLACK regulator lead.

Resistance Specification (Both Tests)
900 K OHMS Minimum

VOLTAGE SPIKE SUPRESSER

1. Set meter to ⊣◀⊢.
2. Connect RED (+) meter lead to regulator case.
3. Connect BLACK (–) meter lead to RED regulator lead.

Voltage Specification
0.4 - 0.7 VOLTS

VOLTAGE SPIKE SUPRESSER DIODE TEST

1. Set meter to ⊣◀⊢.
2. Connect BLACK (–) meter lead to RED regulator lead.
3. Connect RED (+) meter lead to either YELLOW regulator lead. Test.
4. Connect RED (+) meter lead to the other YELLOW regulator lead.

Diode Test Specification (Both Tests)
0.4 - 0.8 VOLTS

DIODE TEST

1. Set meter to ⊣◀⊢.
2. Connect RED (+) meter lead to RED regulator lead.
3. Connect BLACK (–) meter lead to either YELLOW regulator lead. Test.
4. Connect BLACK (–) meter lead to the other YELLOW regulator lead.

Diode Test Specification (Both Tests)
No Continuity - Ouch - OL or ↓

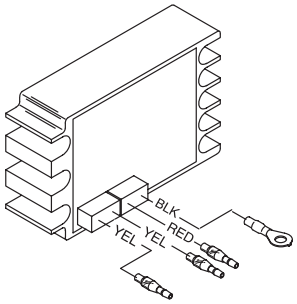
SCR TEST

1. Set meter to ⊣◀⊢.
2. Connect BLACK (–) meter lead to regulator case.
3. Connect RED (+) meter lead to either YELLOW regulator lead. Test.
4. Connect RED (+) meter lead to other YELLOW regulator lead.

SCR Test Specification (Both Tests)
1.5 Volts - No Continuity - Ouch - OL or ↓

Analog Meter

NOTE:*Voltage regulator/rectifier specifications are given for informational purposes only. Use the appropriate troubleshooting techniques previously mentioned to find the faulty component in the charging system.*



BLK = Black
RED = Red
YEL = Yellow

DIODE TEST

1. Set Ohm meter to R X 10 scale.
2. Connect RED(+) meter lead to RED regulator lead.
3. Connect BLACK (–) meter lead to either YELLOW or YELLOW/BLACK regulator lead.

Resistance Specification
100 - 400 OHMS

DIODE TEST

1. Set Ohm meter to R X 1K scale.
2. Connect Black (–) meter lead to RED regulator lead.
3. Connect RED (+) meter lead to YELLOW regulator lead. Test.
4. Connect RED (+) meter lead to the other YELLOW regulator lead.

Test Specification (Both Tests)
40,000 to ↓ OHMS (40 K)

SCR TEST

1. Set Ohm meter to R X 1K scale.
2. Connect RED (+) meter lead to regulator case.
3. Connect BLACK (–) meter lead to the YELLOW regulator lead. Test.
4. Connect BLACK (–) meter lead to the other YELLOW lead.

SCR Test Specification (Both Tests)
10,000 OHMS (10K)

Starting System

STARTER MOTOR AMPERES DRAW

STARTER MOTOR PART NO.	NO LOAD AMP. DRAW	NORMAL AMP. DRAW
50-90983A1	15 AMPS	55 AMPS
Starter Motor Teeth	10	

STARTING SYSTEM COMPONENTS

The starting system consists of the following components.

1. Battery
2. Starter Solenoid
3. Neutral Start Switch
4. Starter Motor
5. Ignition Switch

Description

The function of the starting system is to crank the engine. The battery supplies electrical energy to crank the starter motor. When the ignition switch is turned to “START” position, the starter solenoid is activated and completes the starting circuit between the battery and starter.

The neutral start switch opens the start circuit when the shift control lever is not in neutral. This prevents accidental starting when engine is in gear.

⚠ CAUTION

The starter motor may be damaged if operated continuously. DO NOT operate continuously for more than 30 seconds. Allow a 2 minute cooling period between starting attempts.

Troubleshooting the Starting Circuit

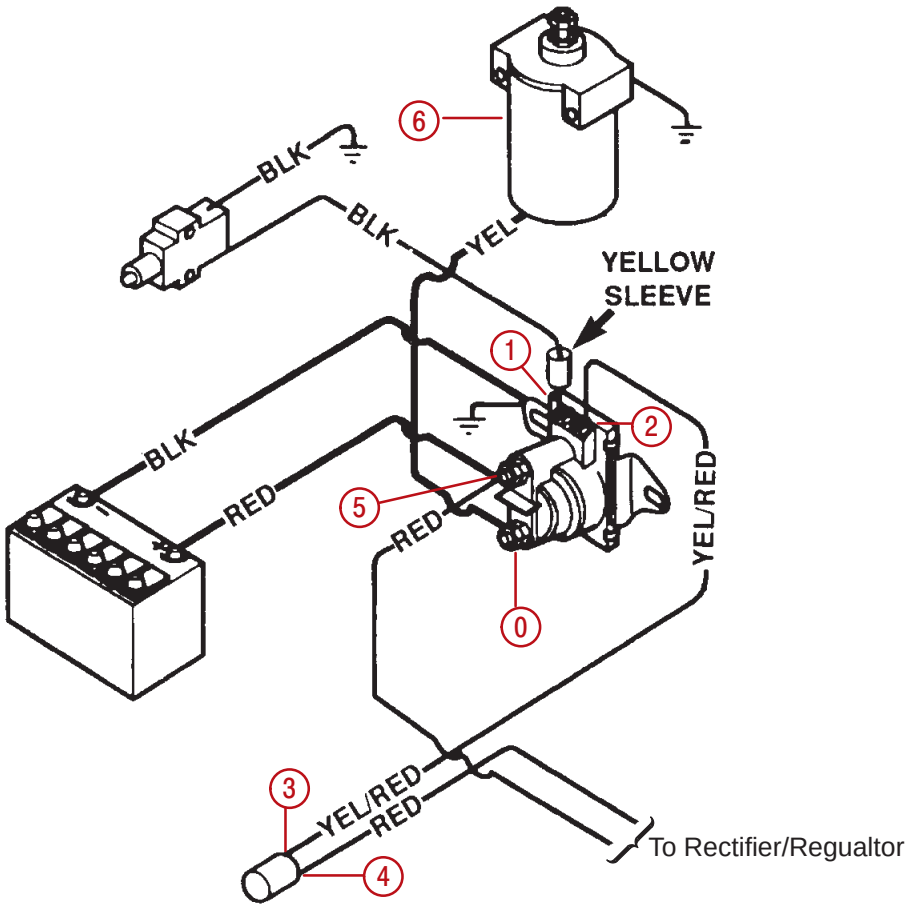
Before beginning the starting circuit troubleshooting flow chart, following, check first for the following conditions:

1. Make sure that battery is fully charged.
2. Check that control lever is in NEUTRAL position.
3. Check terminals for corrosion and loose connections.
4. Check cables and wiring for frayed and worn insulation.
5. Check in-line fuse in RED wire. Refer to wire diagram **SECTION 2D**.

The following STARTING CIRCUIT TROUBLESHOOTING FLOW CHART is designed as an aid to troubleshooting the starting circuit. This flow chart will accurately locate any existing malfunction. Location of TEST POINTS are numbered in diagram below.

IMPORTANT: Remote Control Electric Start Models have a 20 Ampere fuse located under the cowl next to the starter solenoid. This fuse protects the remote control harness. If this fuse is open, the starter will be inoperative. The cause of the blown fuse (a short) should be found and corrected.

Starting Circuit Troubleshooting Flow Chart



53056

Starting Circuit Troubleshooting Flow Chart

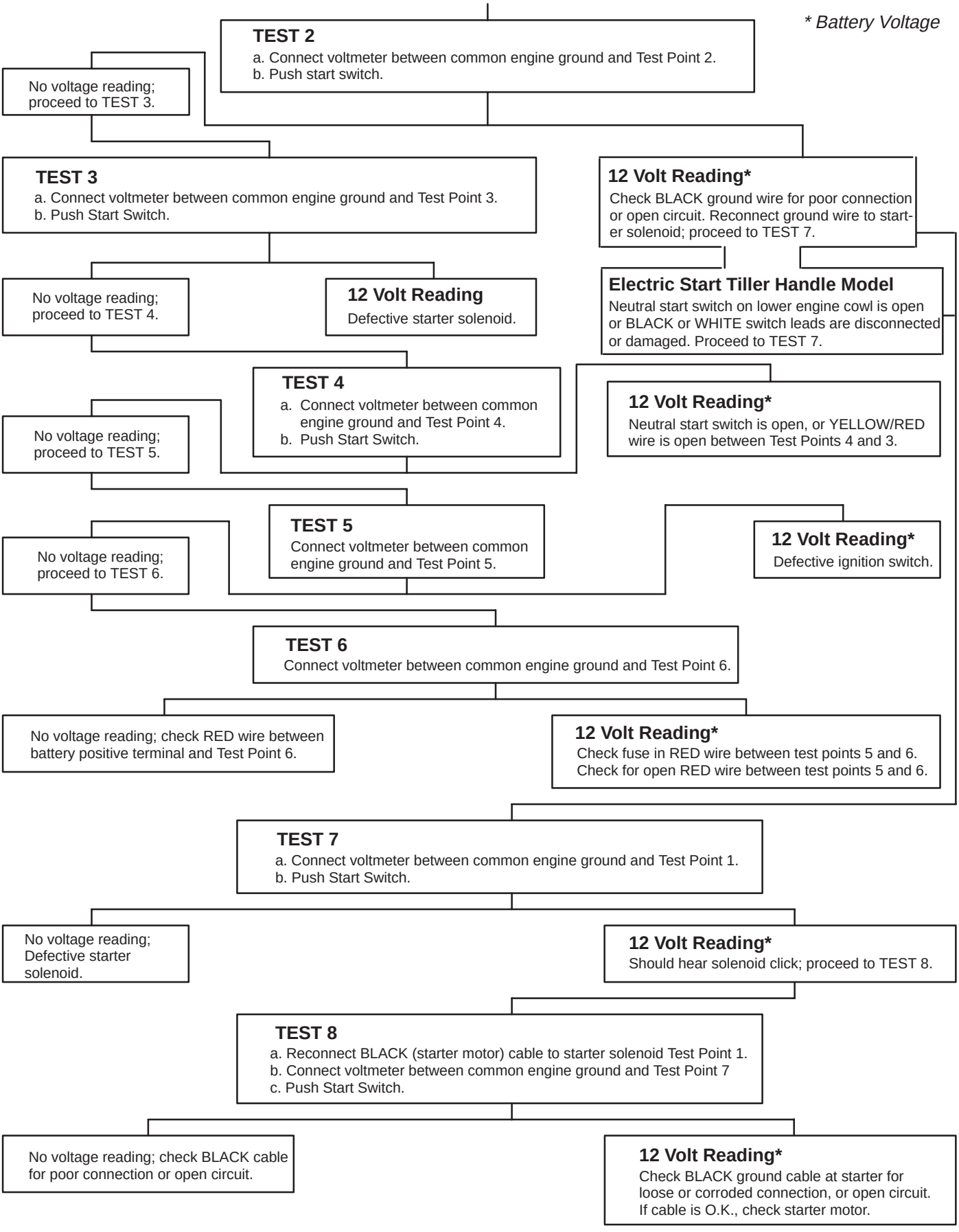
Starter Motor Does Not Turn

SAFETY WARNING: Disconnect BLACK (with YELLOW sleeve) cable from starter solenoid test point 1 BEFORE making tests to prevent unexpected engine cranking.

TEST 1
Use an ohmmeter (R x 1 scale) and connect meter leads between NEGATIVE battery post and common powerhead ground.

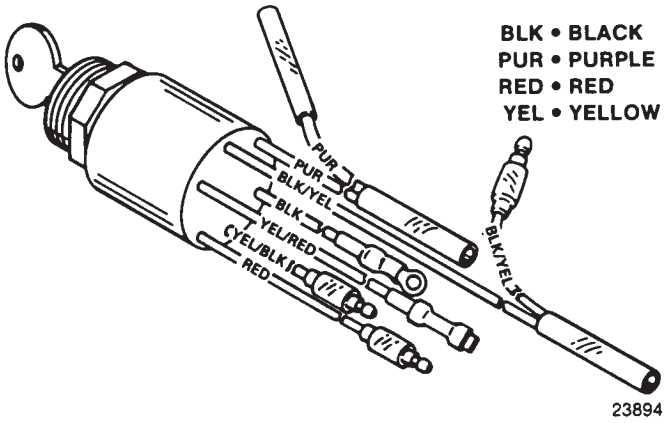
No Continuity Indicated
There is an open circuit in the BLACK NEGATIVE battery cable between the NEGATIVE battery post and the powerhead.
- Check cable for loose or corroded connections.
- Check cable for open.

Continuity Indicated
Proceed to TEST 2, on next page.


* Battery Voltage
TEST 2
a. Connect voltmeter between common engine ground and Test Point 2.
b. Push start switch.
No voltage reading; proceed to TEST 3.
TEST 3
a. Connect voltmeter between common engine ground and Test Point 3.
b. Push Start Switch.
12 Volt Reading*
Check BLACK ground wire for poor connection or open circuit. Reconnect ground wire to starter solenoid; proceed to TEST 7.
No voltage reading; proceed to TEST 4.
12 Volt Reading
Defective starter solenoid.
Electric Start Tiller Handle Model
Neutral start switch on lower engine cowl is open or BLACK or WHITE switch leads are disconnected or damaged. Proceed to TEST 7.
TEST 4
a. Connect voltmeter between common engine ground and Test Point 4.
b. Push Start Switch.
12 Volt Reading*
Neutral start switch is open, or YELLOW/RED wire is open between Test Points 4 and 3.
No voltage reading; proceed to TEST 5.
TEST 5
Connect voltmeter between common engine ground and Test Point 5.
12 Volt Reading*
Defective ignition switch.
No voltage reading; proceed to TEST 6.
TEST 6
Connect voltmeter between common engine ground and Test Point 6.
No voltage reading; check RED wire between battery positive terminal and Test Point 6.
12 Volt Reading*
Check fuse in RED wire between test points 5 and 6.
Check for open RED wire between test points 5 and 6.
TEST 7
a. Connect voltmeter between common engine ground and Test Point 1.
b. Push Start Switch.
No voltage reading; Defective starter solenoid.
12 Volt Reading*
Should hear solenoid click; proceed to TEST 8.
TEST 8
a. Reconnect BLACK (starter motor) cable to starter solenoid Test Point 1.
b. Connect voltmeter between common engine ground and Test Point 7
c. Push Start Switch.
No voltage reading; check BLACK cable for poor connection or open circuit.
12 Volt Reading*
Check BLACK ground cable at starter for loose or corroded connection, or open circuit. If cable is O.K., check starter motor.

COMMANDER 2000 Key Switch Test

1. Disconnect remote control wiring harness and instrument panel connector.
2. Set ohmmeter on R x 1 scale for the following tests:



KEY POSITION	CONTINUITY SHOULD BE INDICATED AT THE FOLLOWING POINTS: BLK	BLK/YEL	RED	YEL/RED	PUR	YEL/BLK
OFF	○———○					
RUN			○———————○			
START			○———○			
				○———○		
			○———————○			
CHOKE*			○———————————○			
			○———————○			
					○———○	

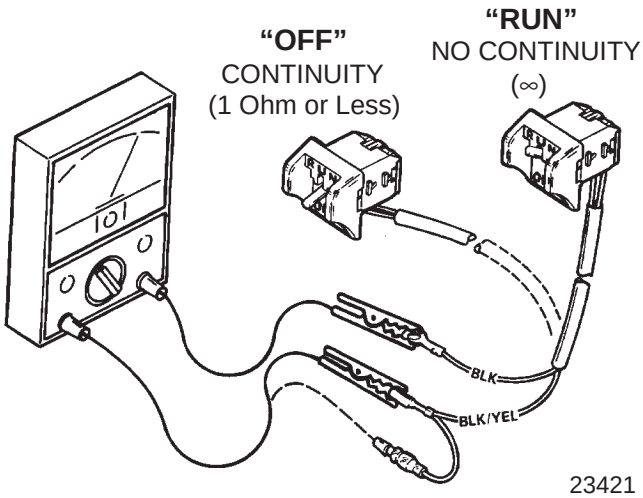
***Key switch must be positioned to "RUN" or "START" and key pushed in to actuate choke for this test.**

3. If meter readings are other than specified in the preceding tests, verify that switch and not wiring is faulty. If wiring checks ok, replace switch.

Emergency Stop Switch (Lanyard Type)

IMPORTANT: Refer to Section 2D-Wiring Diagrams for wiring connections.

1. Disconnect emergency stop switch leads from engine wiring.
2. Use an ohmmeter and perform the following tests.

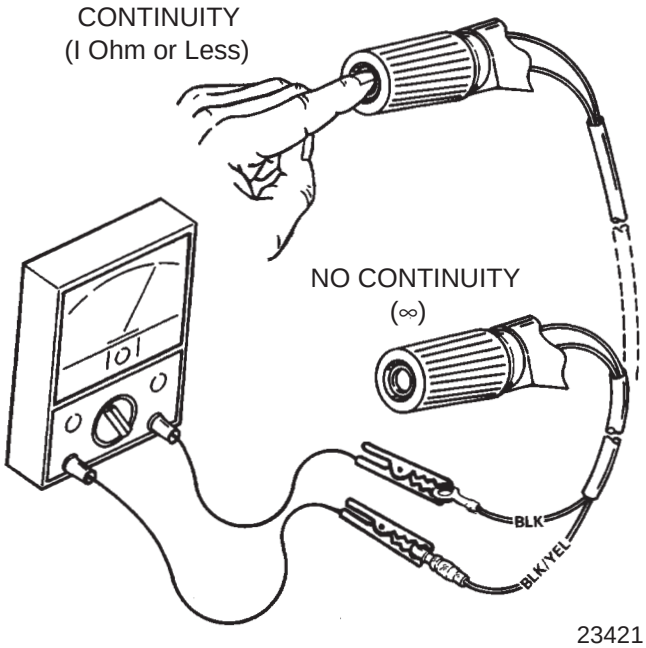


3. If meter readings are other than specified, replace emergency stop switch.

Push Button Stop Switch

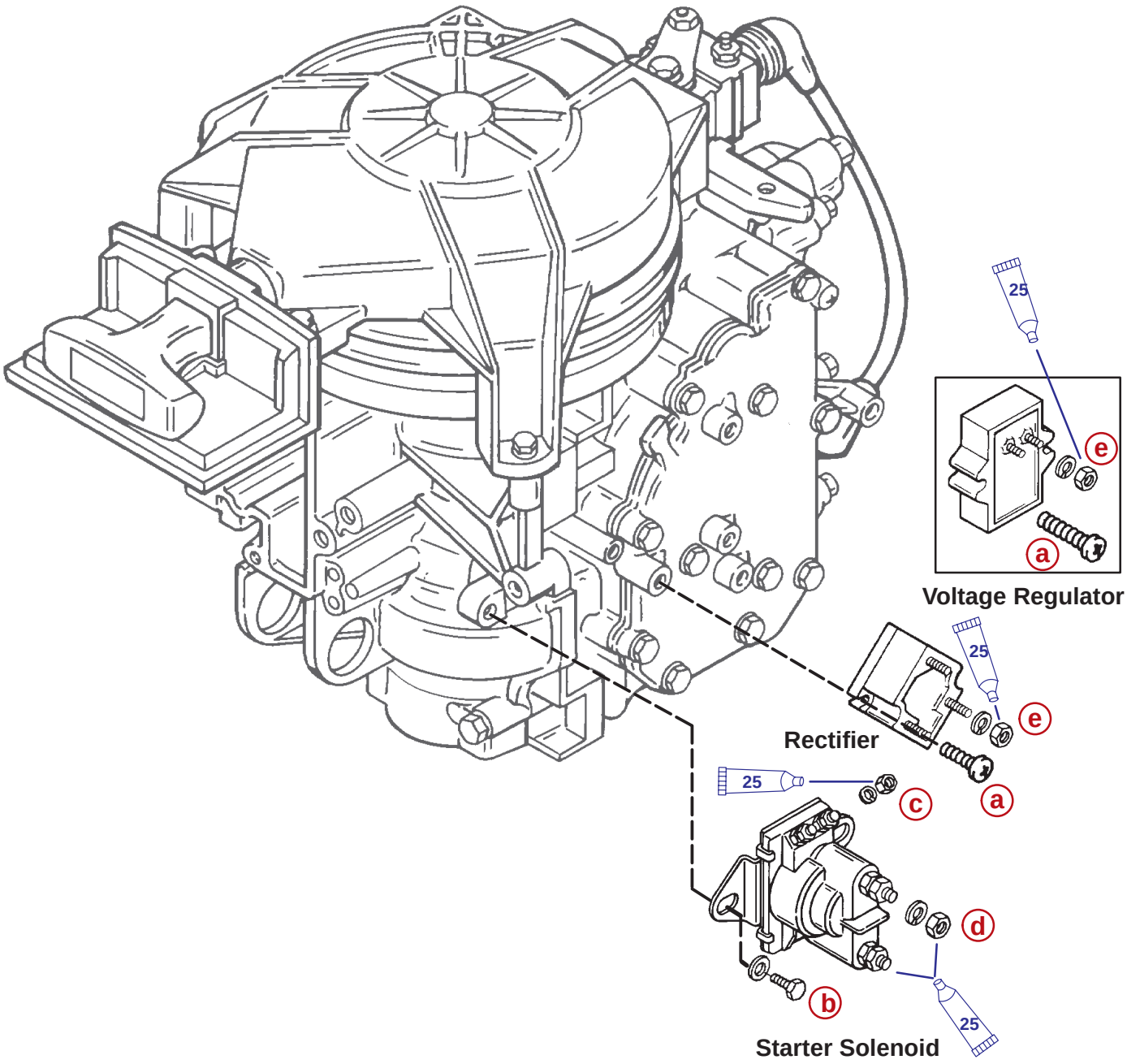
IMPORTANT: Refer to Section 2D-Wiring Diagrams for wiring connections.

1. Disconnect push button stop switch leads from engine wiring.
2. Use an ohmmeter and perform the following tests.



3. If meter readings are other than specified, replace push button stop switch.

Electrical Component Removal and Installation



53261

Torque Specifications

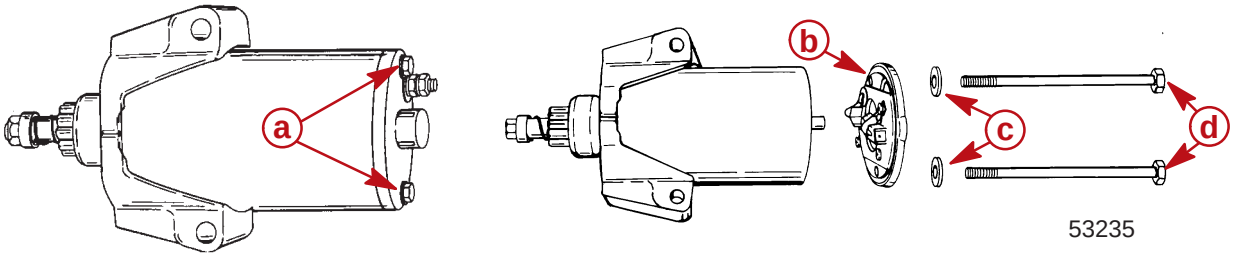
- (a) Tighten Securely
- (b) 70 lb. in. (7.9 N·m)
- (c) 15 lb. in. (1.7 N·m)
- (d) 30 lb. in. (3.4 N·m)
- (e) 25 lb. in. (2.8 N·m)

25 Liquid Neoprene

Starter Motor

Disassembly

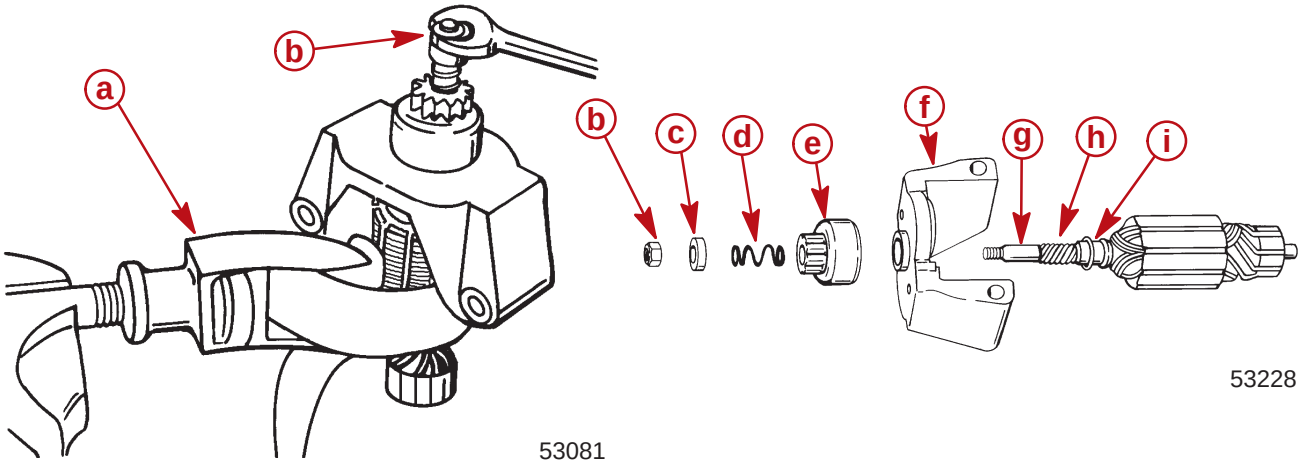
1. Remove 2 thru-bolts from starter.
2. Lightly tap on end of shaft and lower end cap with rubber mallet. Do not lose brush springs.



53235

a - Bolts
b - Lower end cap
c - Washers
d - Bolts

3. Tap on drive end cap to loosen. Remove end cap and armature from starter housing.
4. If removal of parts that are installed on armature is necessary, hold armature with Strap Wrench and remove locknut from end of shaft and discard.
5. Remove parts from shaft.



53081

53228

a - Strap Wrench (91-24937A1)
b - Locknut (discard)
c - Spacer
d - Spring
e - Drive Assembly
f - Drive end cap
g - Armature shaft
h - Helix threads
i - Washer

Cleaning and Inspection

1. If brushes are pitted, chipped or worn to less than 4.8mm (3/16 in.), replace brushes.

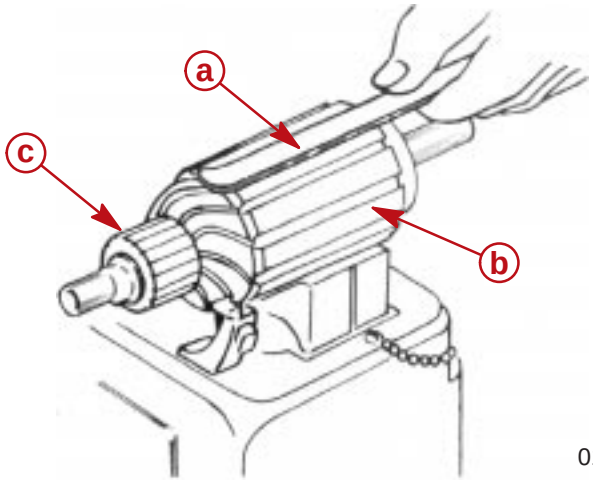
IMPORTANT: DO NOT clean the starter drive assembly or armature shaft while starter motor is installed on outboard. The cleaning solution will drain dirt into motor housing.

2. If the motor drive assembly does not fully engage with flywheel, the drive assembly may be binding on the helix threads on the armature shaft due to dirt or wear. Locate cause of binding and correct before reassembling.
3. Clean drive components with cleaning solution and inspect parts for wear.
4. Clean commutator with No. 00 sandpaper. Remove any oil from commutator. If commutator surface is pitted, rough or worn unevenly, resurface on a lathe.
5. Resurface commutator on a lathe as follows:
   a. Use a lathe to turn down the commutator surface. DO NOT turn down the commutator surface excessively.
   b. Clean copper particles from slots between commutator bars.
   c. Sand the commutator lightly with No. 00 sandpaper to remove burrs. Thoroughly clean the armature after resurfacing and sanding.

Testing Motor Armature

TESTING ARMATURE FOR SHORTS

1. Place armature in a growler and switch growler on.
2. Hold hack saw blade over armature core while rotating armature.
3. If saw blade vibrates, armature is shorted. Retest after cleaning between commutator bars. If saw blade still vibrates, replace armature.

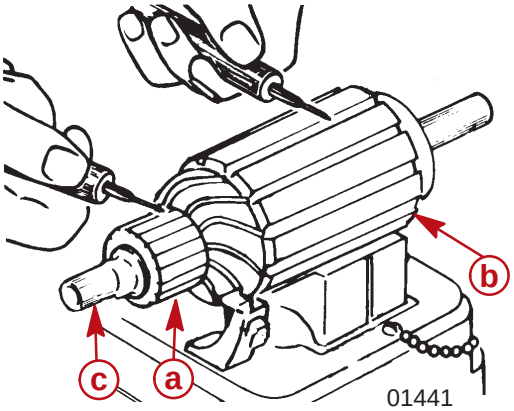


01440

a - Hack saw blade
b - Armature core
c - Commutator

TESTING ARMATURE FOR GROUND

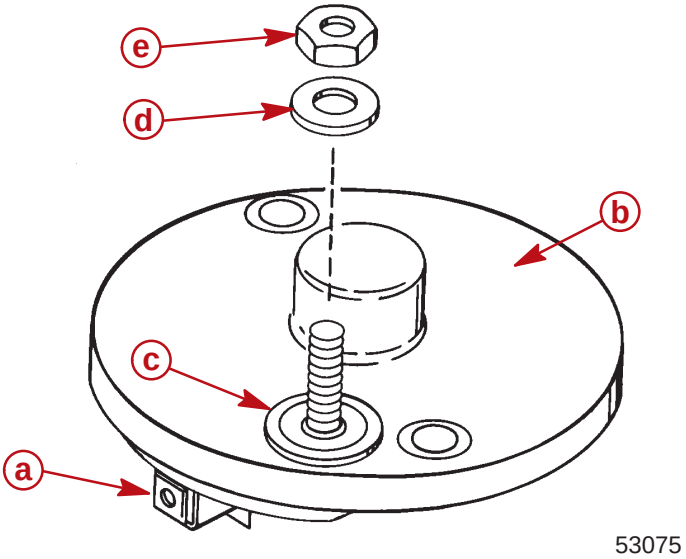
1. Use an ohmmeter (R x 100) to check for no continuity between commutator and armature core or commutator and shaft.
2. If continuity exists, armature is grounded and must be replaced.



a - Commutator
b - Core
c - Shaft

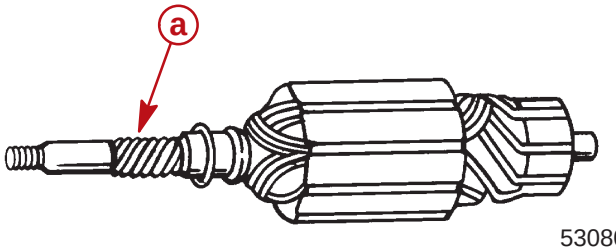
Starter Motor Reassembly

1. Reinstall brush assembly.

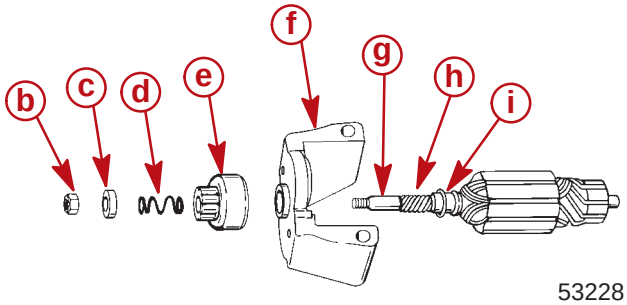


a - Brush
b - End cap
c - Fiber washer
d - Metal washer
e - Nut

2. Apply a drop of SAE 10W oil to to helix threads on armature shaft. DO NOT over lubricate.
3. Apply a drop of SAE 10W oil to bushings in drive end cap and lower end cap. DO NOT over lubricate.
4. Reinstall components on armature shaft. Use a new locknut and tighten securely.



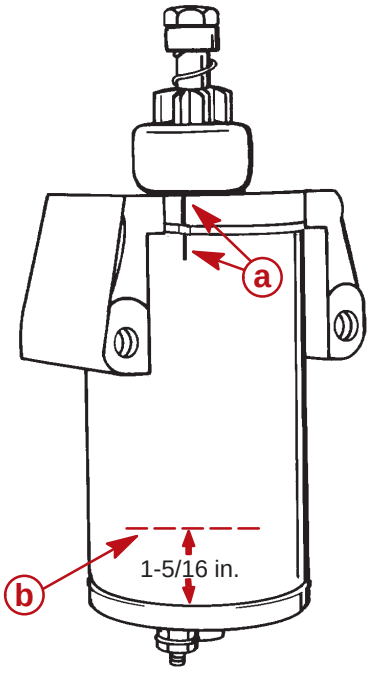
53080



53228

a - Helix threads
b - Locknut
c - Spacer
d - Spring
e - Drive assembly
f - Drive end cap
g - Armature shaft
h - Helix threads
i - Washer

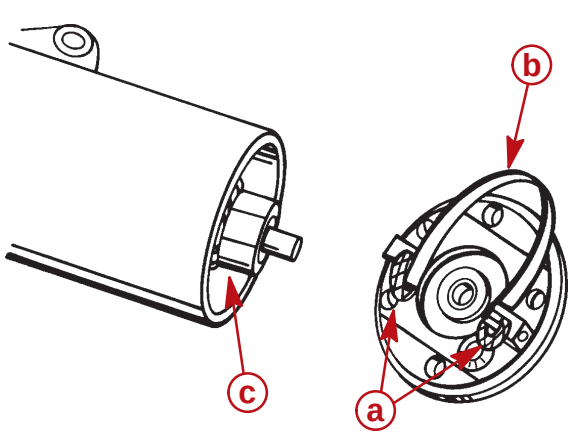
5. Position armature into starter frame so that commutator end of armature is at end of starter frame where permanent magnets are recessed 33.3mm (1-5/16 in.). Align marks as shown.



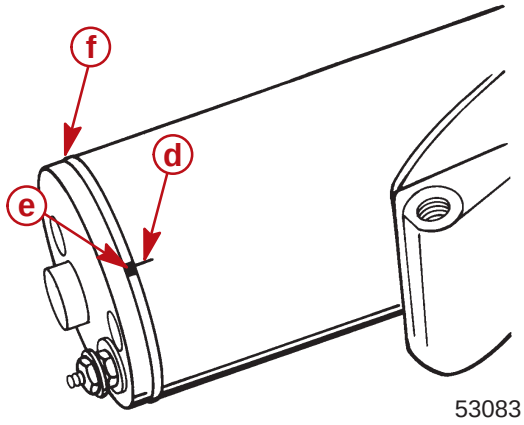
53082

a - Alignment marks
b - Bottom edge of permanent magnets

6. Install springs and brushes into brush holders. Spread brushes and hold in place with a strip of spring steel.
7. Push in on drive end of shaft so that commutator will extend out of starter frame.
8. Install lower end cap onto starter frame.



53213



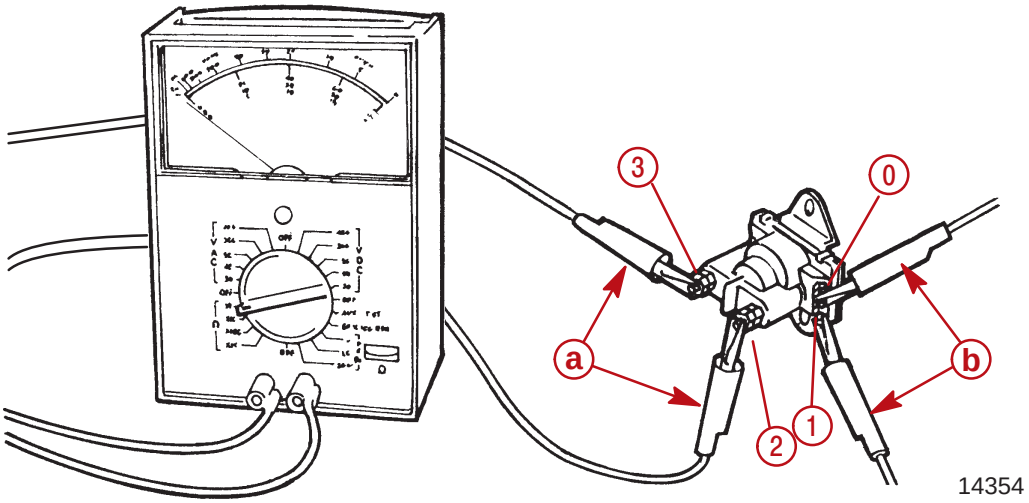
53083

a - Brushes
b - Spring steel
c - Commutator
d - Alignment mark; must align with slot
e - Slot
f - Lower end cap

Starter Solenoid Test

Test starter solenoid as follows:

1. Disconnect all leads from solenoid terminals.
2. Use an ohmmeter, set to R x 1 scale and connect between solenoid terminals 3 and 4.
3. Connect a 12-volt supply between solenoid terminals 1 and 2. Solenoid should click and meter should read zero ohms.
4. If meter does not read zero ohms (full continuity), replace solenoid.



14354

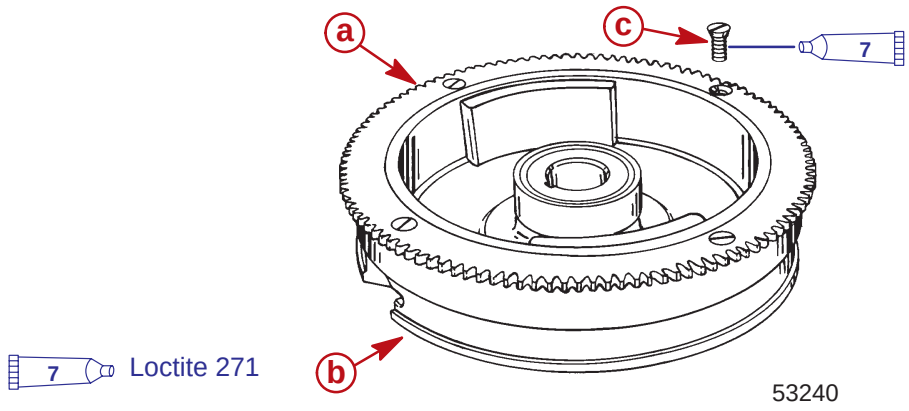
a - Ohmmeter leads
b - 12-volt supply

Flywheel Ring Gear

Installation

IMPORTANT: Before installing ring gear on flywheel, inspect gear and flywheel for paint runs which will prevent ring gear from laying flat against flywheel.

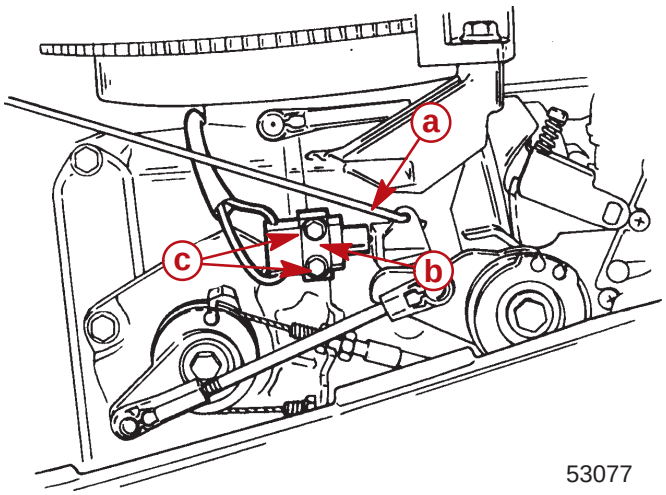
1. Inspect (and remove) any paint runs on ring gear and/or mounting surface on flywheel.
2. Place gear on flywheel with countersink side of mounting holes toward the outside.
3. Apply Loctite 271 to threads of 4 gear mounting screws and secure gear to flywheel. Torque screws to 11.3 Nm (100 lb. in).



a - Ring gear
b - Flywheel
c - Screws [Torque to 11.3 Nm (100 lb. in.)]

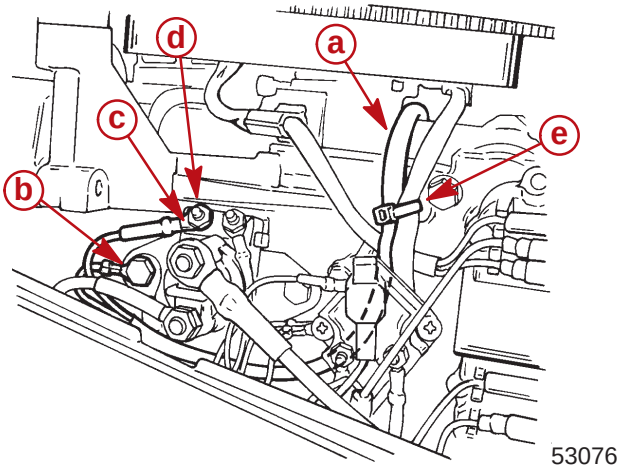
Neutral Start Switch (Electric Start Tiller Handle Shift Models)

1. Mount neutral start switch onto control platform with 2 bolts and plate.
2. Torque mounting bolts to 0.6 Nm (5 lb. in.).



a - Neutral start switch
b - Plate
c - Bolts [Torque to 0.6 Nm (5 lb. in.)]

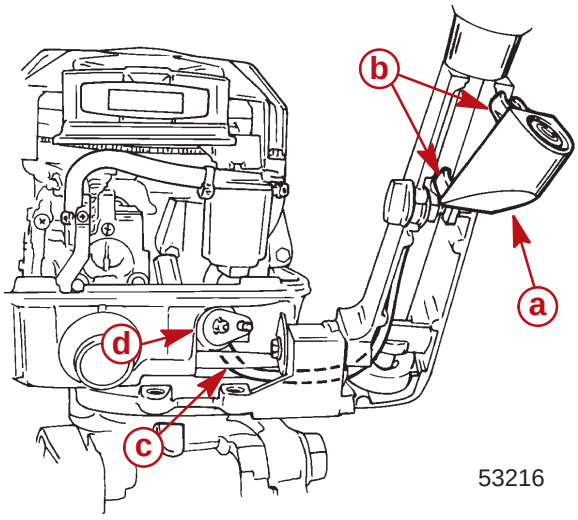
3. Route switch harness over block. Secure harness to stator harness with cable-tie.
4. Route harness behind rectifier. Attach BLACK lead to solenoid mount bolt. Attach BLACK lead with YELLOW sleeve to terminal 1 of starter solenoid.



a - Switch harness
b - BLACK lead
c - BLACK lead with YELLOW sleeve
d - Terminal 1
e - Cable-tie

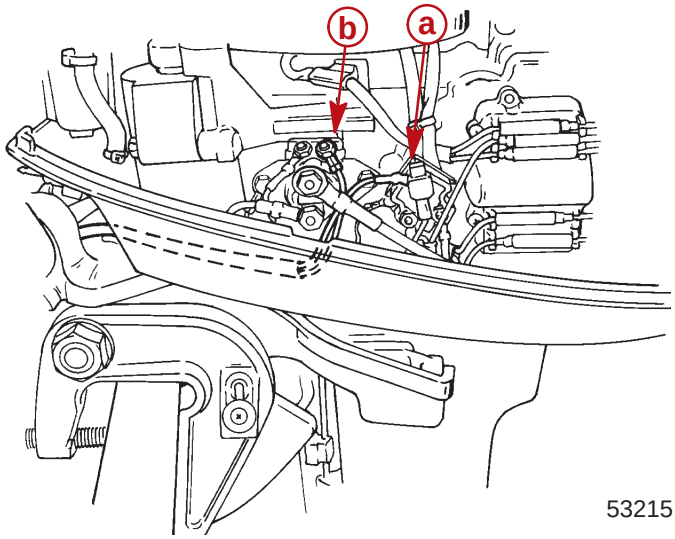
Tiller Handle Start Button

1. The tiller handle start button assembly is secured to the tiller handle by 2 semi-loops which snap fit onto the tiller throttle shaft. To remove the button assembly, pry the assembly away from the tiller handle with a flat tip screwdriver.
2. The starter button harness is routed into the lower cowl through the fuel connector access hole.



a - Start button assembly
b - Semi-loops
c - Harness
d - Fuel connector

3. The starter button harness is routed down the PORT side of lower engine to cowl.
4. The RED harness lead is connected to the POSITIVE terminal of the rectifier. Torque attaching nut to 2.8 Nm (25 lb. in.).
5. The YELLOW/RED harness lead attaches to the #2 terminal of the starter terminal. Torque attaching nut to 1.7 Nm (15 lb. in.).



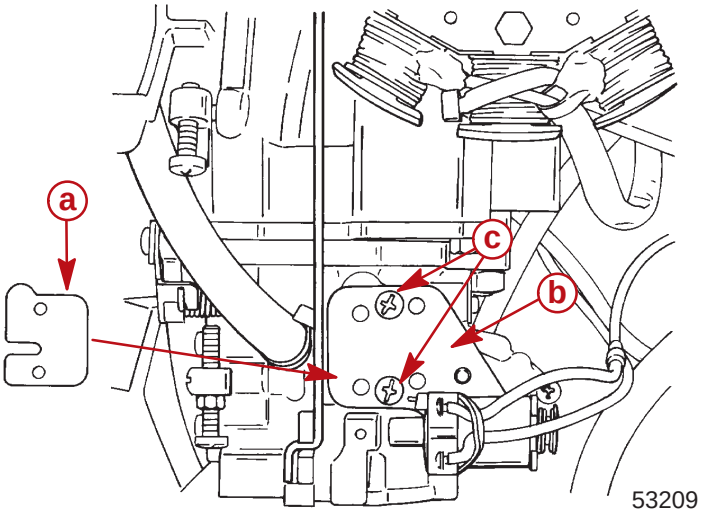
a - RED Lead [Torque nut to 2.8 Nm (25 lb. in.)]
b - YELLOW/RED Lead [Torque nut to 1.7 Nm (15 lb. in.)]

Choke Solenoid

Installation

IMPORTANT: New gasket MUST be positioned as shown when being installed.

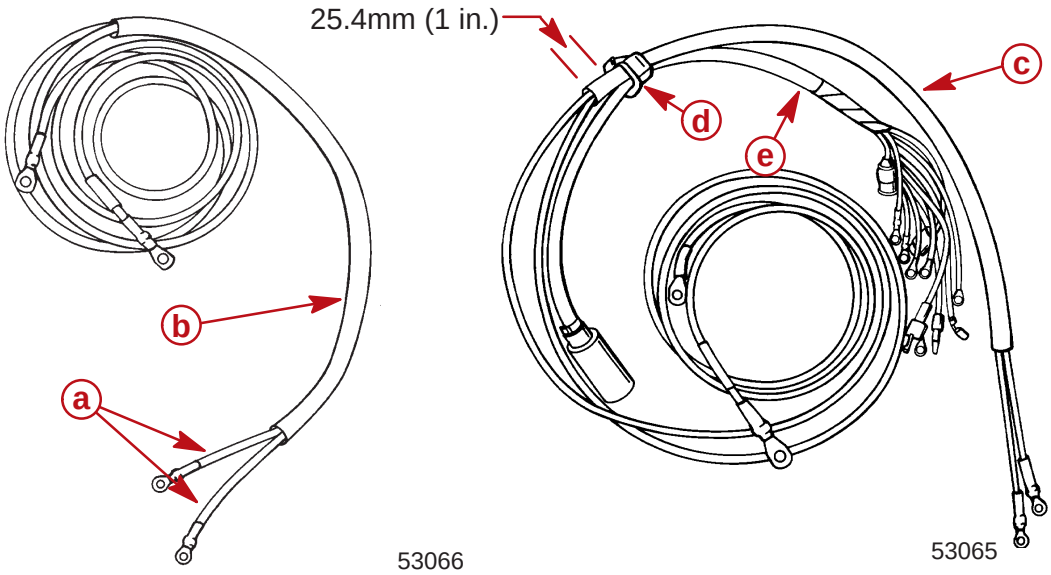
1. Install new gasket with solenoid plate assembly.
2. Secure assembly with 2 screws. Torque screws to 2.0 Nm (18 lb. in.).



a - Gasket
b - Solenoid plate
c - Screws [Torque to 2.0 Nm (18 lb. in.)]

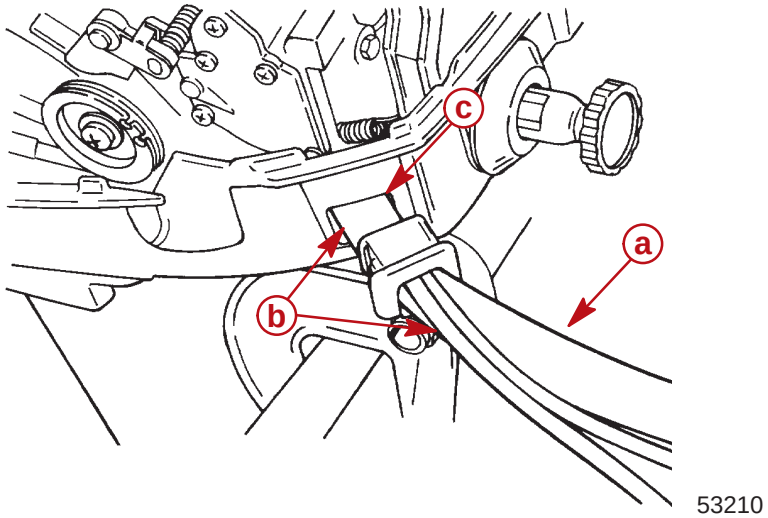
Battery Cables/Engine Wiring Harness (Remote Electric Start Models)

1. Slide battery cables through sleeve.
2. Thread battery cable/sleeve through wire retainer of engine wiring harness. Verify 25.4mm (1 in.) of sleeve remains to the outside of wire retainer.



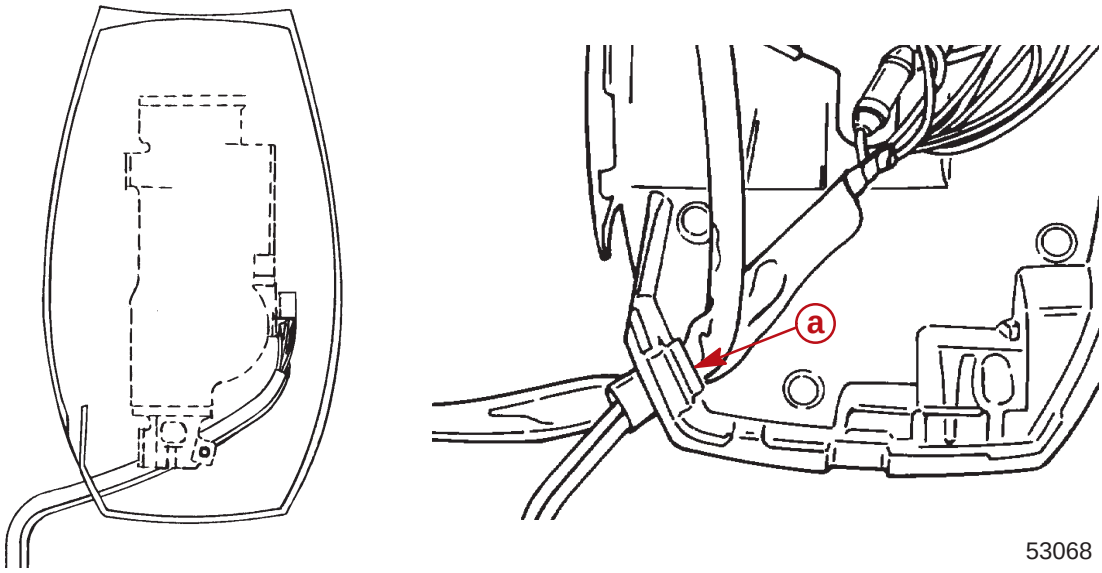
a - Battery cables
b - Sleeve
c - Sleeve
d - Retainer
e - Harness

3. Remove carburetor as outlined in **Section 3.**
4. Thread engine wiring harness first and then battery cable/sleeve through opening in bottom cowl.



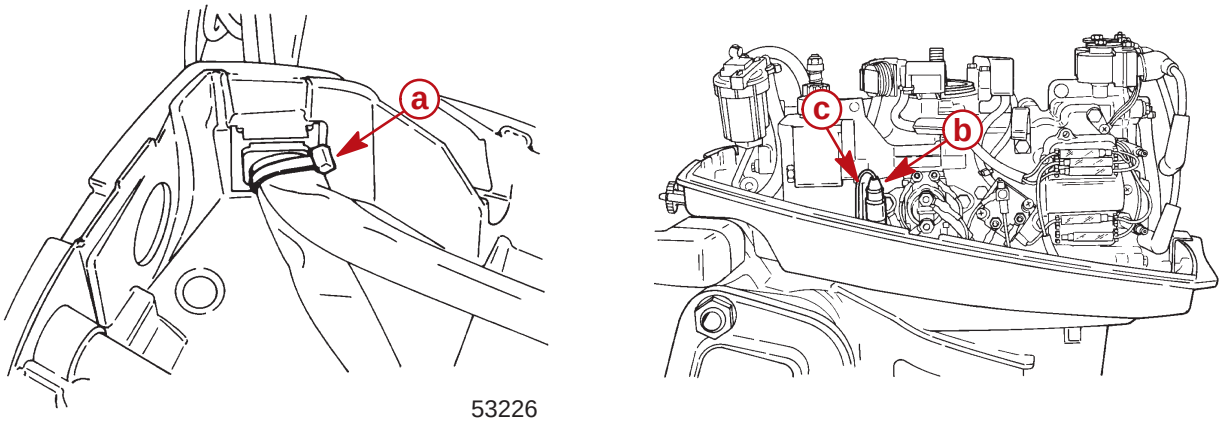
a - Harness
b - Battery cable/sleeve
c - Opening

5. Route engine wiring harness and battery cable/sleeve (under carburetor location) around to PORT side of cylinder block.
6. Push wire retainer into opening of bottom cowl and secure with clip.



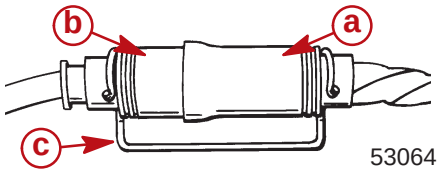
a - Clip

7. Secure harness and battery cable/sleeve with cable-tie just inside bottom cowl.
8. Reinstall carburetor. Refer to **Section 3A**.
9. Secure fuse holder in J-clip.



a - Cable-tie
b - Fuse holder
c - J-clip

10. Plug remote control harness connector into engine wiring harness connector and secure with harness connector retainer.

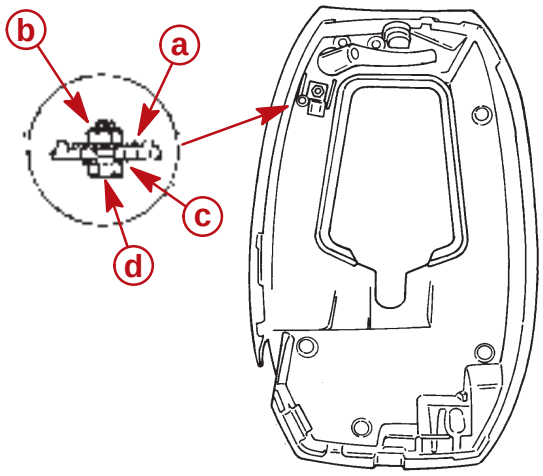


a - Remote control harness
b - Engine harness
c - Retainer

Battery Cables
(Tiller Handle Push Button Electric Start Models)

Installation

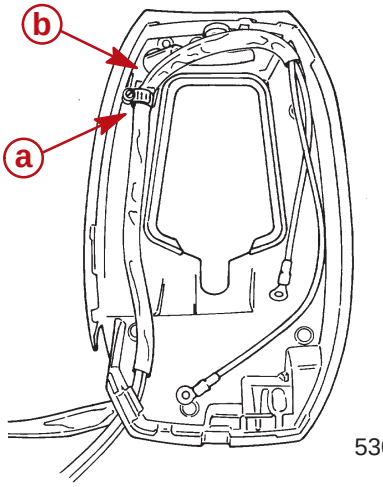
1. Fasten harness clamp to bottom cowl with nut, washer and bolt.



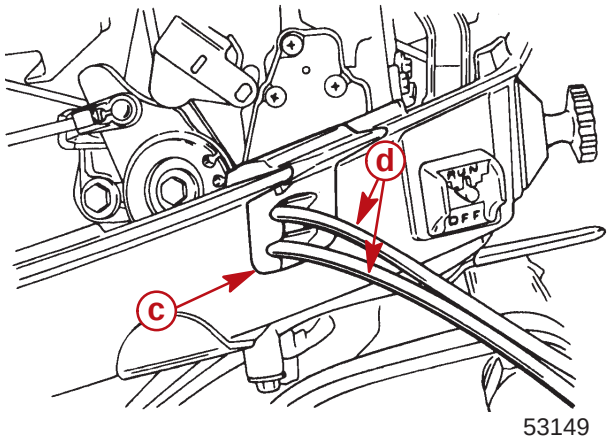
53069

a - Clamp
b - Nut
c - Washer
d - Bolt

2. Slide battery cables through sleeve.
3. Slide harness clamp over battery cable sleeve and position cables into bottom cowl.
4. Position harness clamp onto clamp bracket in bottom cowl. Tighten clamp securely.
5. Slide battery cable grommet over battery cables and install grommet into opening in starboard bottom cowl.



53067



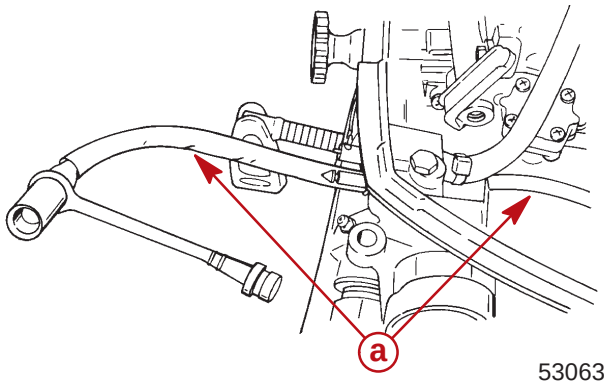
53149

a - Clamp
b - Bracket
c - Grommet
d - Cables

Plug Harness (Battery Charging Kit)

Installation

1. Install plug harness through fuel fitting opening in bottom cowl.
2. Route harness along PORT side of engine to rectifier.



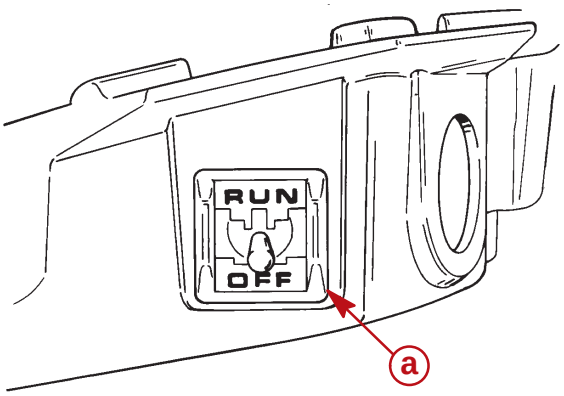
a - Harness

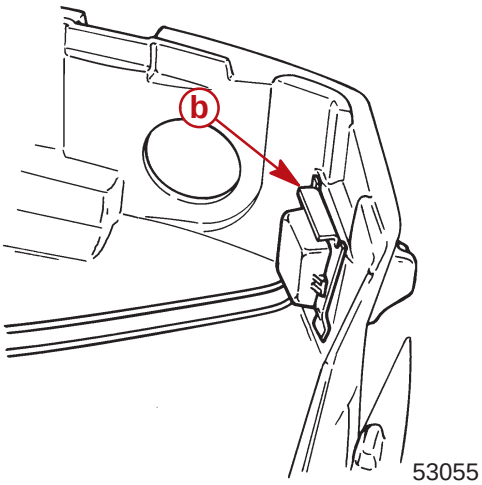
3. Refer to **Section 2D** for wiring connections.

Emergency Stop Switch (Lanyard Type)

Installation

1. Route emergency stop switch wiring through opening in STARBOARD bottom cowl.
2. Secure stop switch into opening in bottom cowl using clip.





a - Stop Switch
b - Clip

3. Refer to **Section 2D** for wiring connections.

ELECTRICAL AND IGNITION

Section 2C – Timing, Synchronizing & Adjusting

Table of Contents

Specifications 2C-1
Special Tools 2C-2
Adjustments 2C-2
Side Shift Models 2C-2
Tiller Handle Shift Models 2C-3
Maximum Timing Adjustment 2C-4
Idle Timing Adjustment 2C-4
Fast Idle Adjustment 2C-5

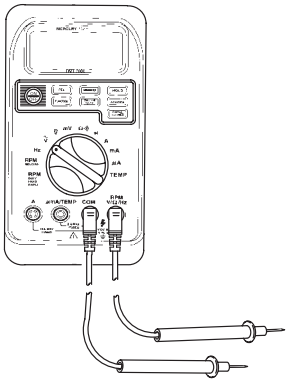
2 C

Specifications

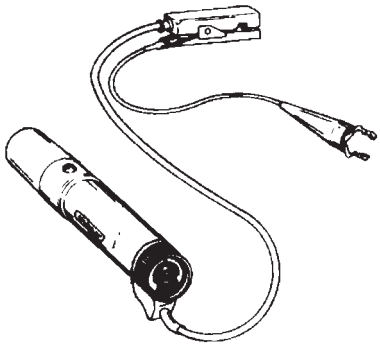
MAXIMUM TIMING	36° BTDC
IDLE TIMING **6/8/9.9/10/15**	 8° BTDC ± 1°
IDLE RPM IN FORWARD GEAR – **6** **8/9.9/15** **10 SEA PRO** **MARATHON** **XR/MAG/VIKING 10** **15 SEA PRO** **MARATHON**	 650 ± 75 725 ± 50 850 ± 50 850 ± 50 725 ± 50 725 ± 50
FULL THROTTLE RPM **6** **8** **9.9/10/15**	 4000 – 5000 4500 – 5500 5000 – 6000
SPARK PLUG (1994) **6/8/9.9** **10/15** **SPARK PLUG GAP** **6/8/9.9** **10/15**	 NGK BP8H-N-10 NGK BP8HS-15 1.0mm (0.040 in.) 1.5mm (0.060 in.)
SPARK PLUG (1995 AND NEWER) **6/8** **9.9/10/15** **SPARK PLUG GAP** **6/8** **9.9/10/15**	 NGK BP8H-N-10 NGK BP8HS-15 1.0mm (0.040 in.) 1.5mm (0.060 in.)
NEUTRAL FAST IDLE	1500 – 2000 RPM

Special Tools

1. DMT 2000 Service Tachometer 91-854009A1



2. Timing Light 91-99379

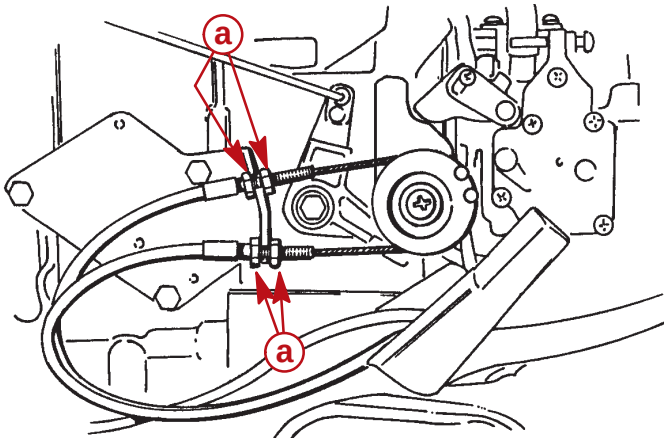


Adjustments

1. Place engine in water.

Side Shift Models

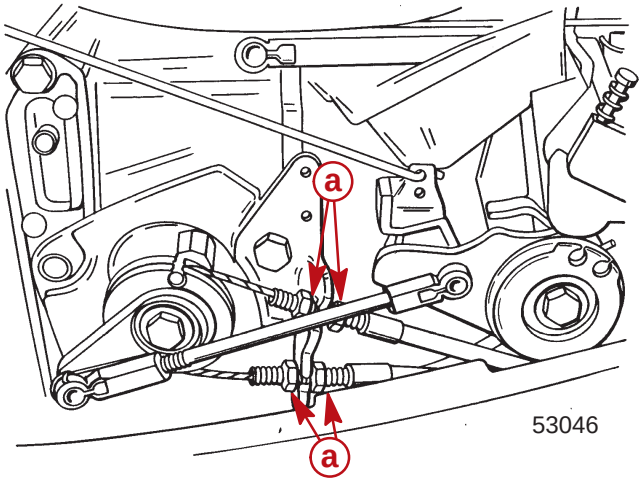
1. Check tiller handle cable adjustment for full throttle movement in both **Forward** and **Reverse** gears.
2. Adjust jam nuts for proper travel and to eliminate any slack.



a - Jam nuts

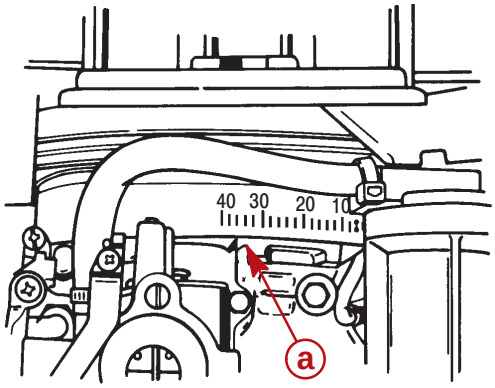
Tiller Handle Shift Models

1. Rotate tiller handle twist grip to NEUTRAL.
2. Adjust jam nuts to remove slack from control cables while allowing full travel of throttle/shift linkage.



a - Jam nuts

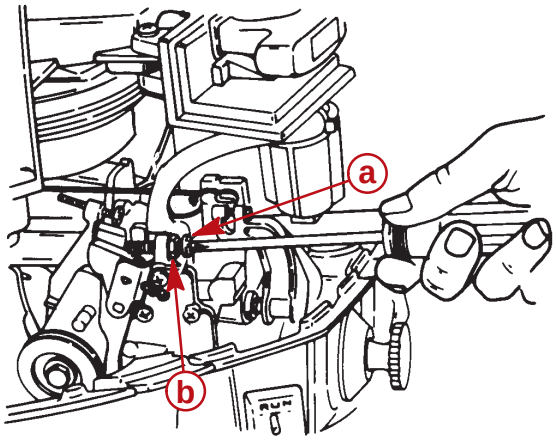
TIMING POINTER LOCATION



a - Timing pointer

Maximum Timing Adjustment

1. Connect timing light to No. 1 (top) spark plug lead.
2. With engine in **Forward** gear, fully advance throttle to WOT (Wide Open Throttle) position.
3. Adjust maximum spark advance screw to align the 36° BTDC (Before Top Dead Center) timing mark on flywheel with timing pointer. Tighten jam nut if so equipped.
4. Adjust low speed mixture screw. Refer to **Section 3A-Carburetor Adjustments**.



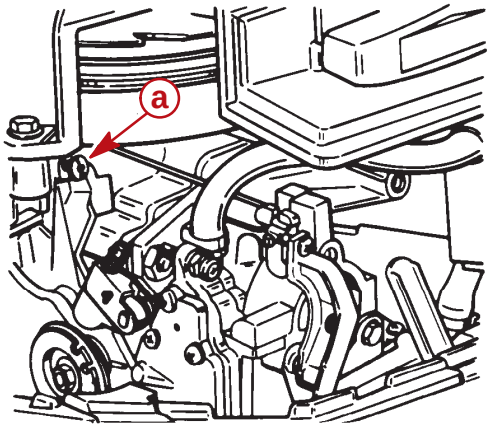
a - Maximum spark advance screw
b - Jam nut

Idle Timing Adjustment

1. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.
2. With engine running in **Forward** gear, reduce engine speed to idle.

IMPORTANT: It may be necessary to adjust idle speed screw to obtain a reasonably stabilized idle.

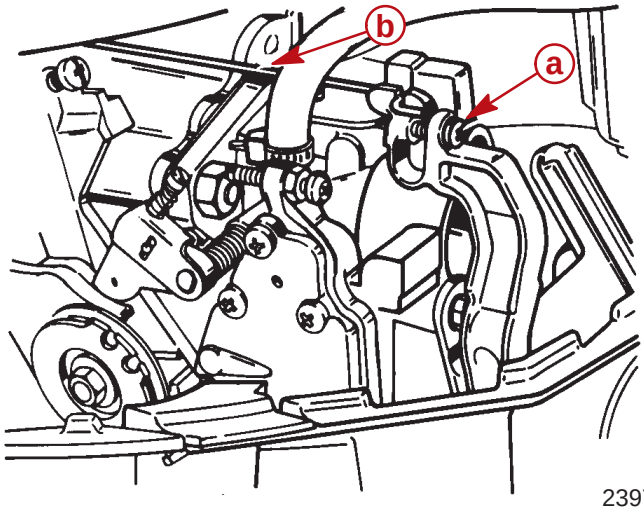
3. Adjust idle timing adjustment screw to align the specified idle timing mark on flywheel with timing pointer.
4. Shift to **Neutral** gear and stop engine.



a - Idle timing adjustment screw

Fast Idle Adjustment

1. Push primer/fast idle knob completely in and rotate knob fully COUNTERCLOCKWISE.
2. Shift outboard to NEUTRAL.
3. Adjust screw to remove all clearance between idle wire and trigger.



23970

a - Fast idle screw
b - Idle wire

4. Check fast idle by turning primer knob to full CLOCKWISE position. Fast idle speed should be 1500 – 2000 RPM.

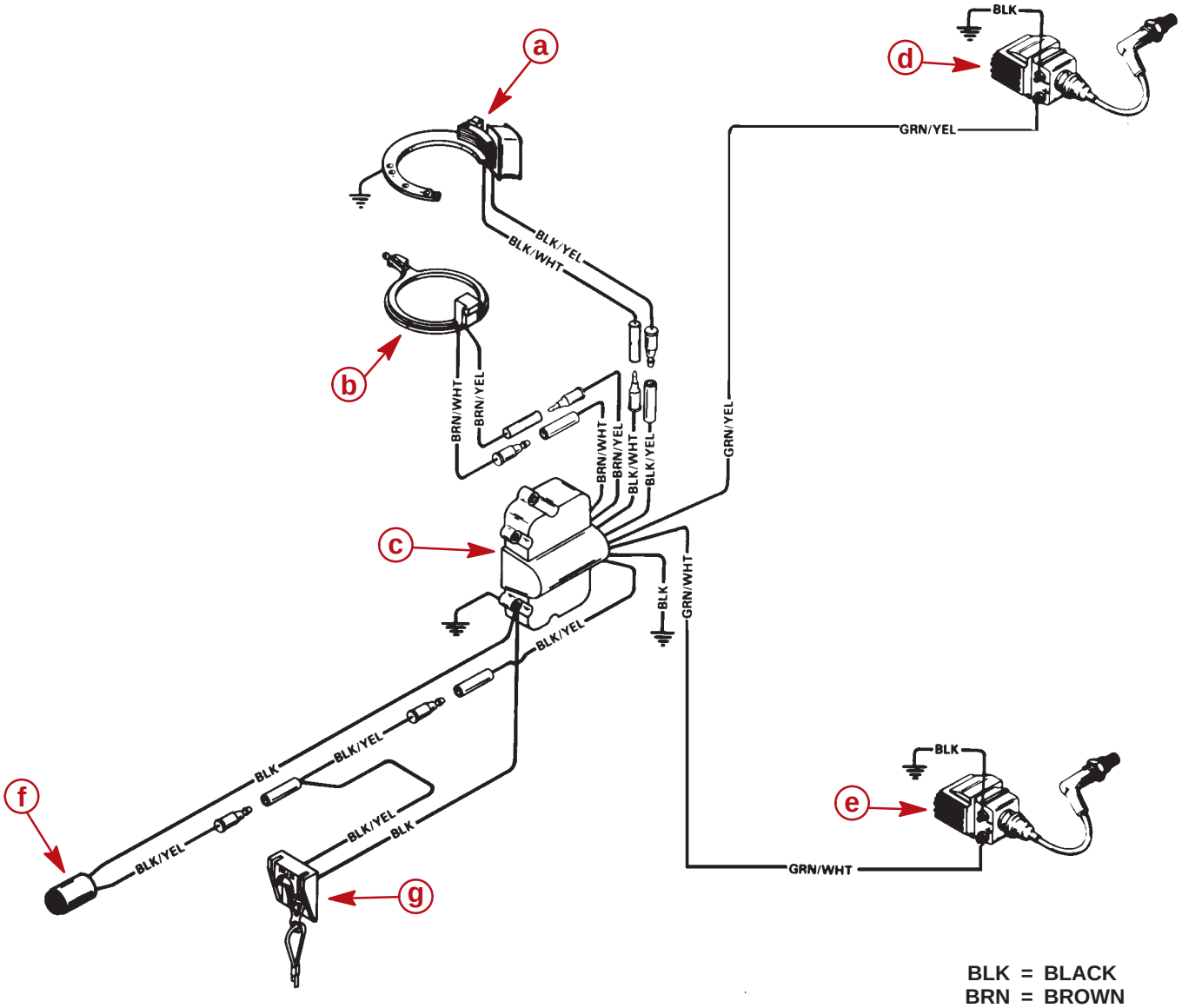
ELECTRICAL AND IGNITION

Section 2D – Wiring Diagrams

Table of Contents

Manual Start Ignition Wiring Diagram (1998 And Prior) 2D-2
Electric Start Models with Tiller Handle Start Button (1998 And Prior) 2D-3
Electric Models Equipped with Remote Control (1998 And Prior) 2D-4
Manual Start Ignition Wiring Diagram (1999 And Newer) 2D-5
Manual Start Ignition Wiring Diagram (1999 And Newer) (Marathon and Sea Pro Models) 2D-6
Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design I) 2D-7
Electric Models Equipped with Remote Control (1999 And Newer, Design I) 2D-8
Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design II) 2D-9
Electric Models Equipped with Remote Control (1999 And Newer, Design II) 2D-10
Optional Electrical Accessories Wiring Diagrams 2D-11
Commander 2000 Remote Control (Manual) 2D-12
Commander 2000 Remote Control (Electric Start) 2D-13
Commander 3000 Panel Mount Control 2D-14

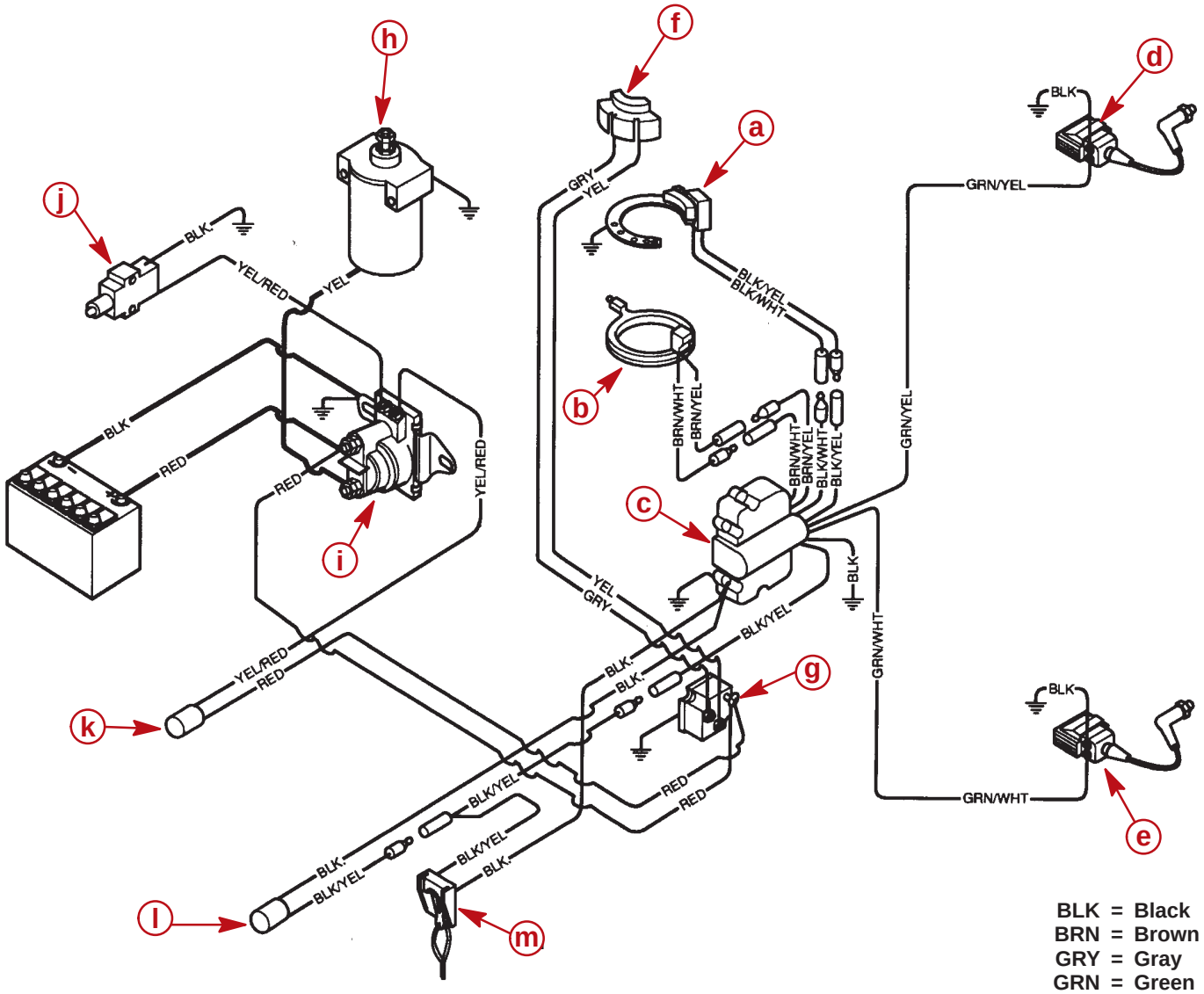
Manual Start Ignition Wiring Diagram (1998 And Prior)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

a - Stator
b - Trigger
c - Switch box
d - Ignition coil top cylinder
e - Ignition coil bottom cylinder
f - Stop switch
g - Emergency stop switch

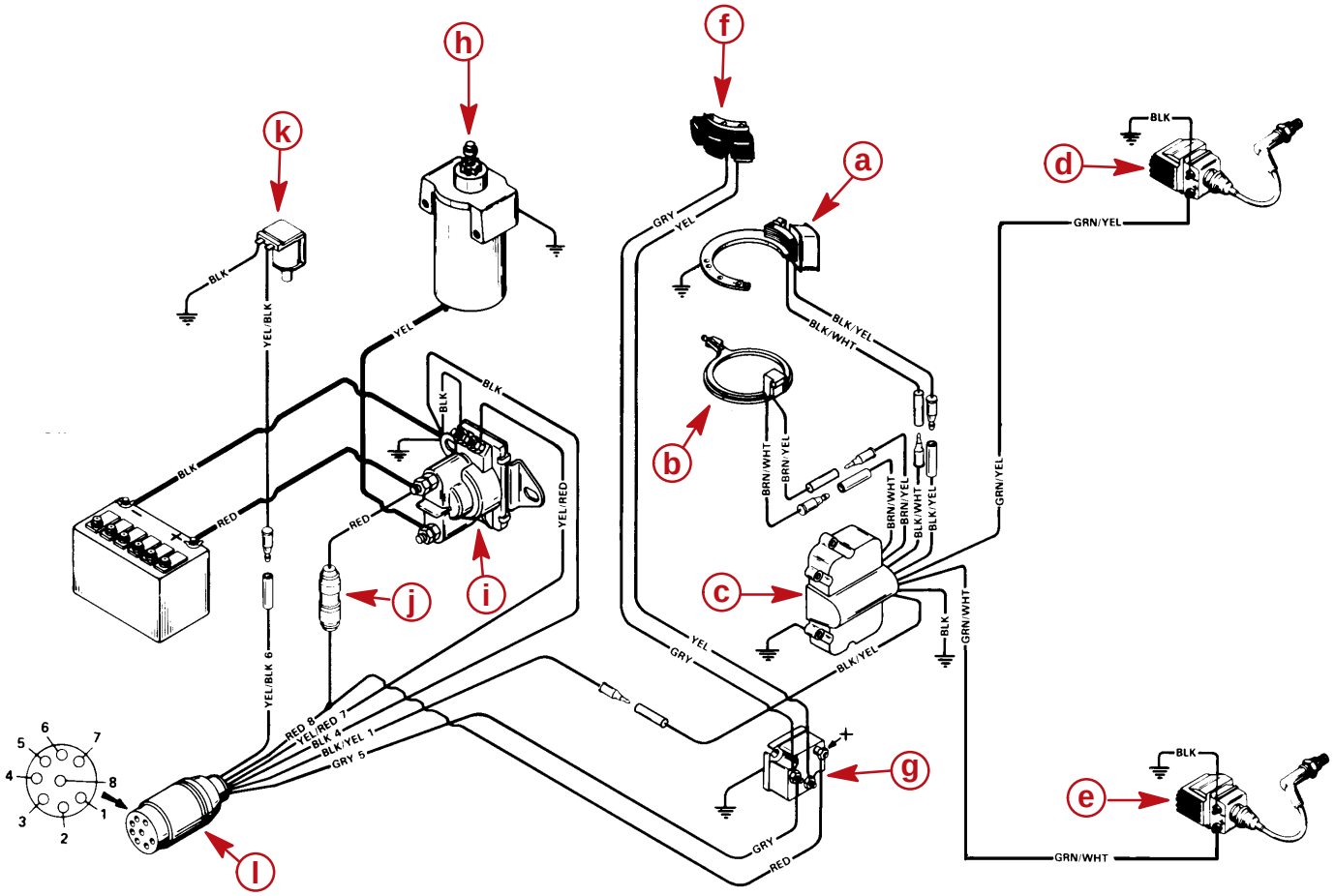
Electric Start Models with Tiller Handle Start Button (1998 And Prior)



BLK = Black
BRN = Brown
GRY = Gray
GRN = Green
RED = Red
WHT = White
YEL = Yellow

a - Stator
b - Trigger
c - Switch box
d - Ignition coil top cylinder
e - Ignition coil bottom cylinder
f - Alternator stator
g - Rectifier
h - Starter motor
i - Starter solenoid
j - Neutral start switch
k - Start switch
l - Stop switch
m - Emergency stop switch

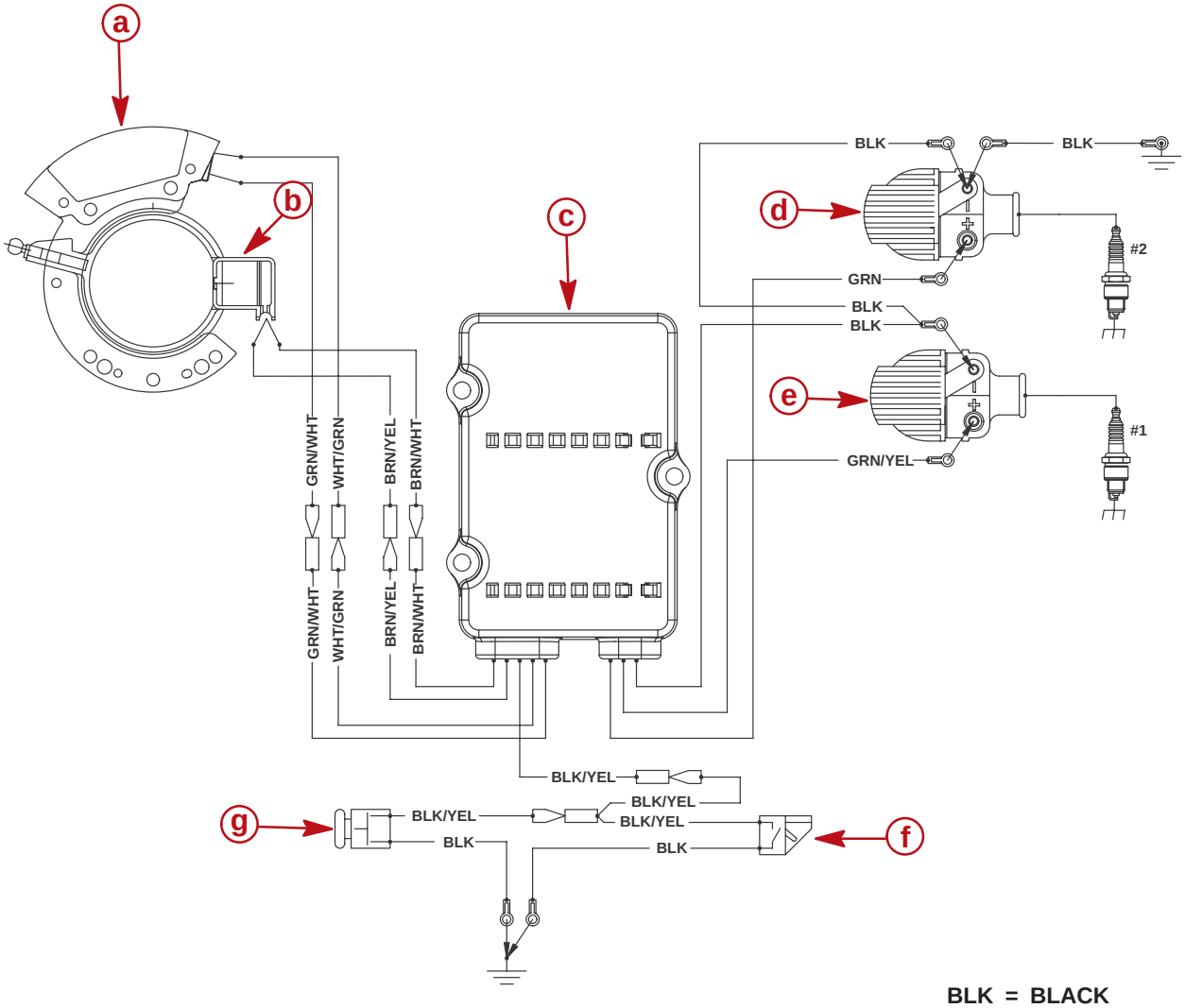
Electric Models Equipped with Remote Control (1998 And Prior)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

a - Stator
b - Trigger
c - Switch box
d - Ignition coil top cylinder
e - Ignition coil bottom cylinder
f - Alternator stator
g - Rectifier
h - Starter motor
i - Starter solenoid
j - Fuse holder (20 ampere fuse)
k - Choke solenoid
l - Wiring harness

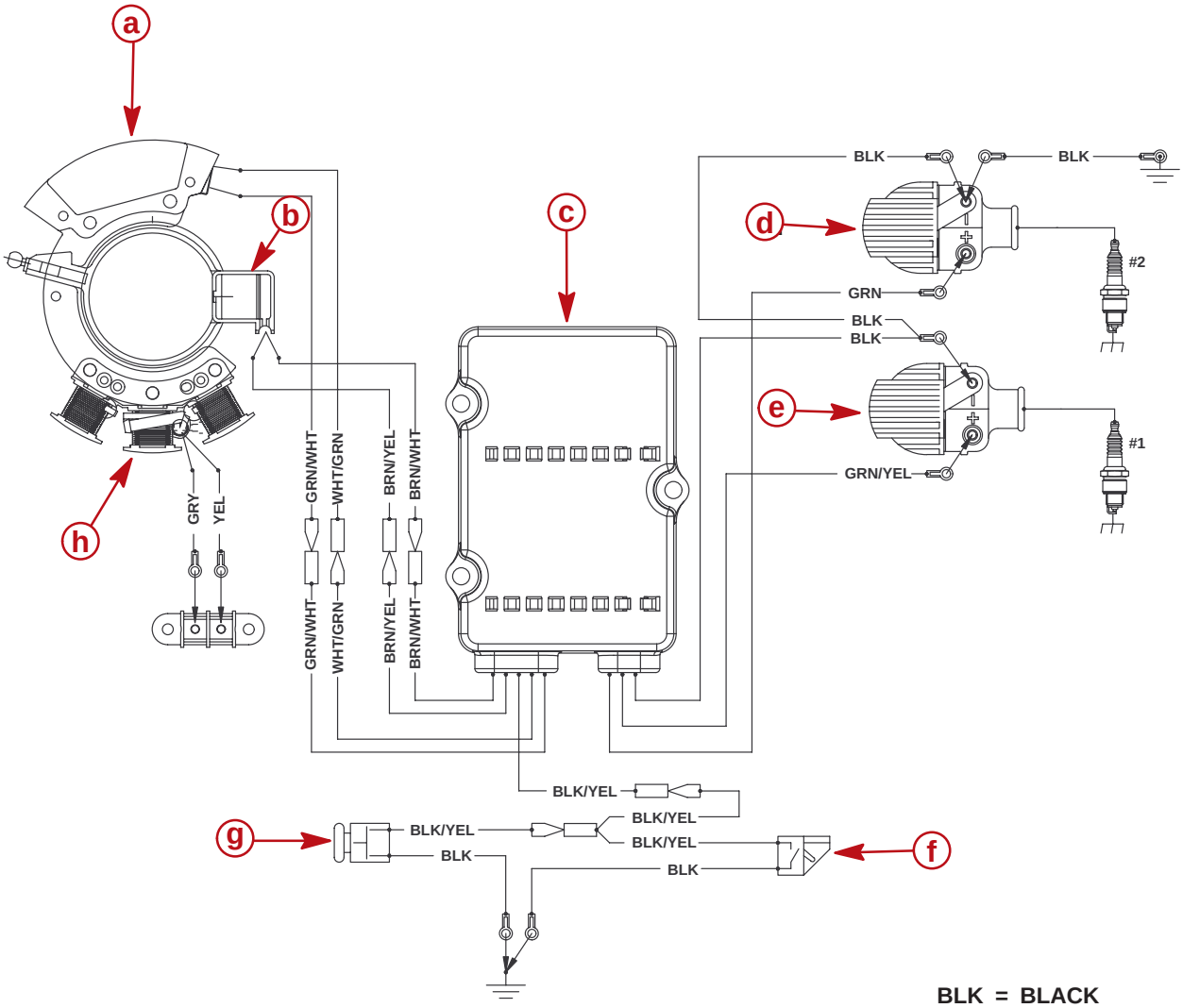
Manual Start Ignition Wiring Diagram (1999 And Newer)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

a - Stator
b - Trigger
c - Switch box
d - Ignition coil bottom cylinder
e - Ignition coil top cylinder
f - Emergency stop switch
g - Stop switch

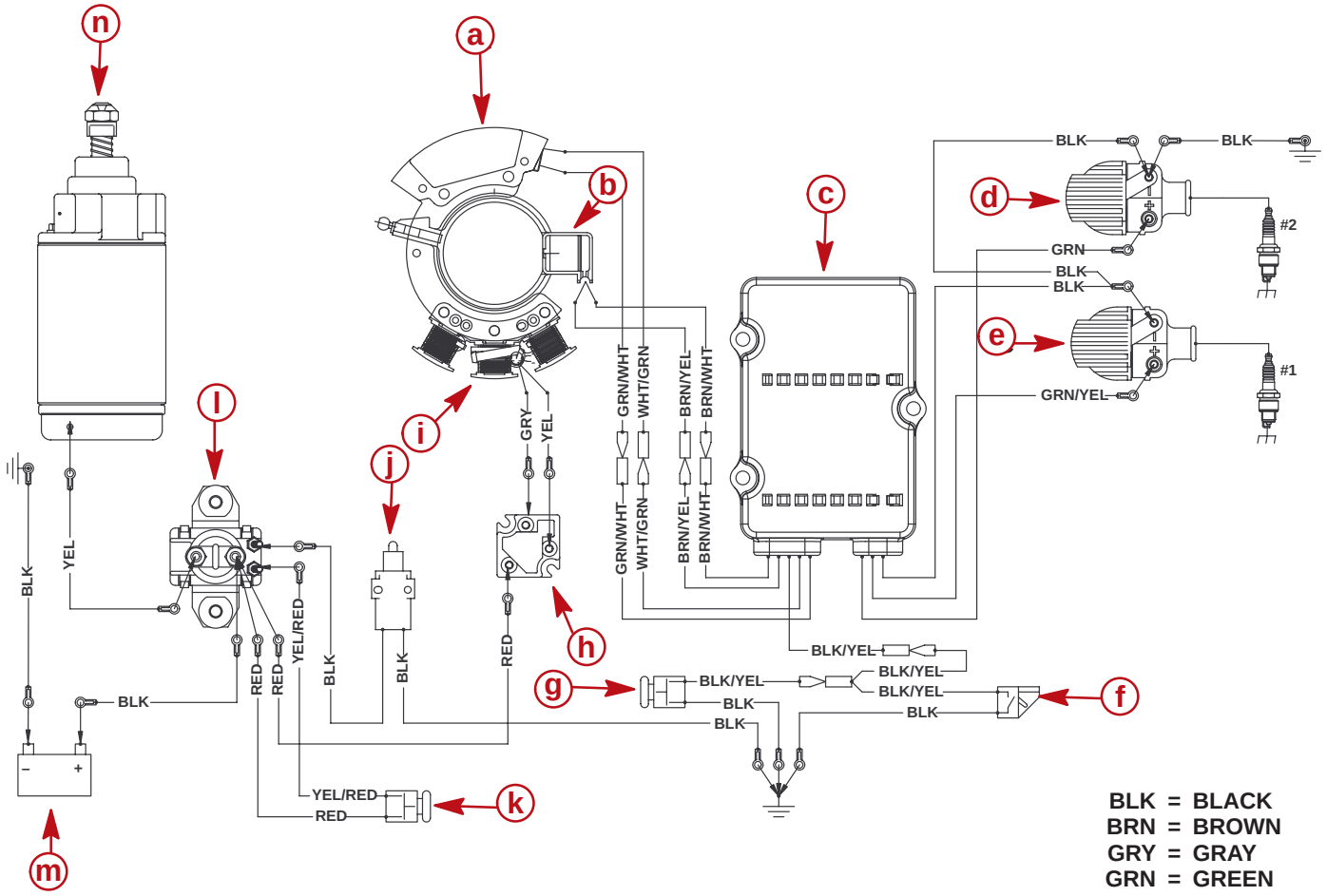
Manual Start Ignition Wiring Diagram (1999 And Newer) (Marathon and Sea Pro Models)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

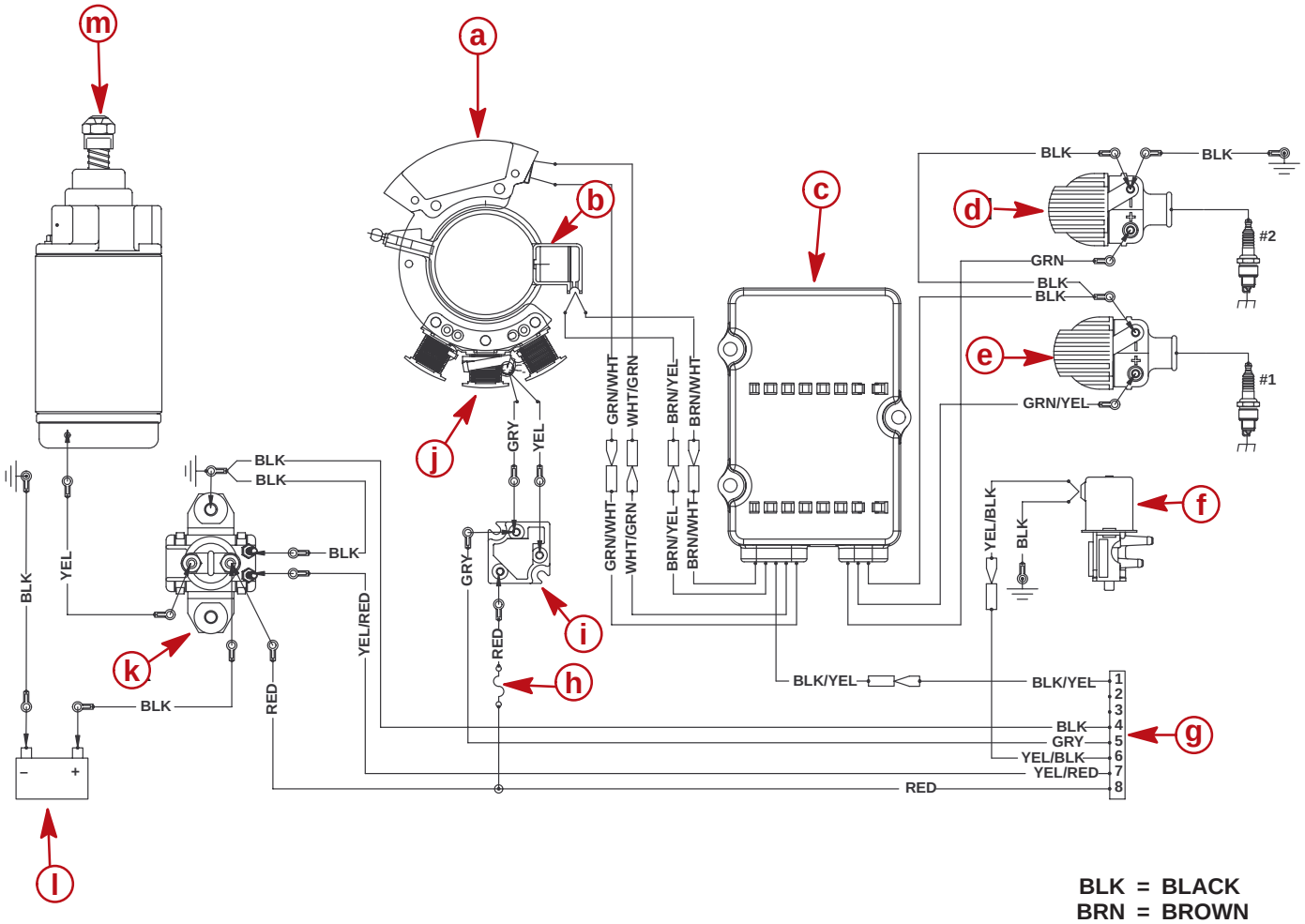
a - Stator
b - Trigger
c - Switch box
d - Ignition coil bottom cylinder
e - Ignition coil top cylinder
f - Stop switch
g - Emergency stop switch
h - Alternator stator

Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design I)



- **a** - Stator
- **b** - Trigger
- **c** - Switch cox
- **d** - Ignition coil bottom cylinder
- **e** - Ignition coil top cylinder
- **f** - Emergency stop switch
- **g** - Push button stop switch
- **h** - Rectifier
- **i** - Alternator stator
- **j** - Neutral start switch
- **k** - Push button start switch
- **l** - Start solenoid
- **m** - 12 VDC battery
- **n** - Starter motor

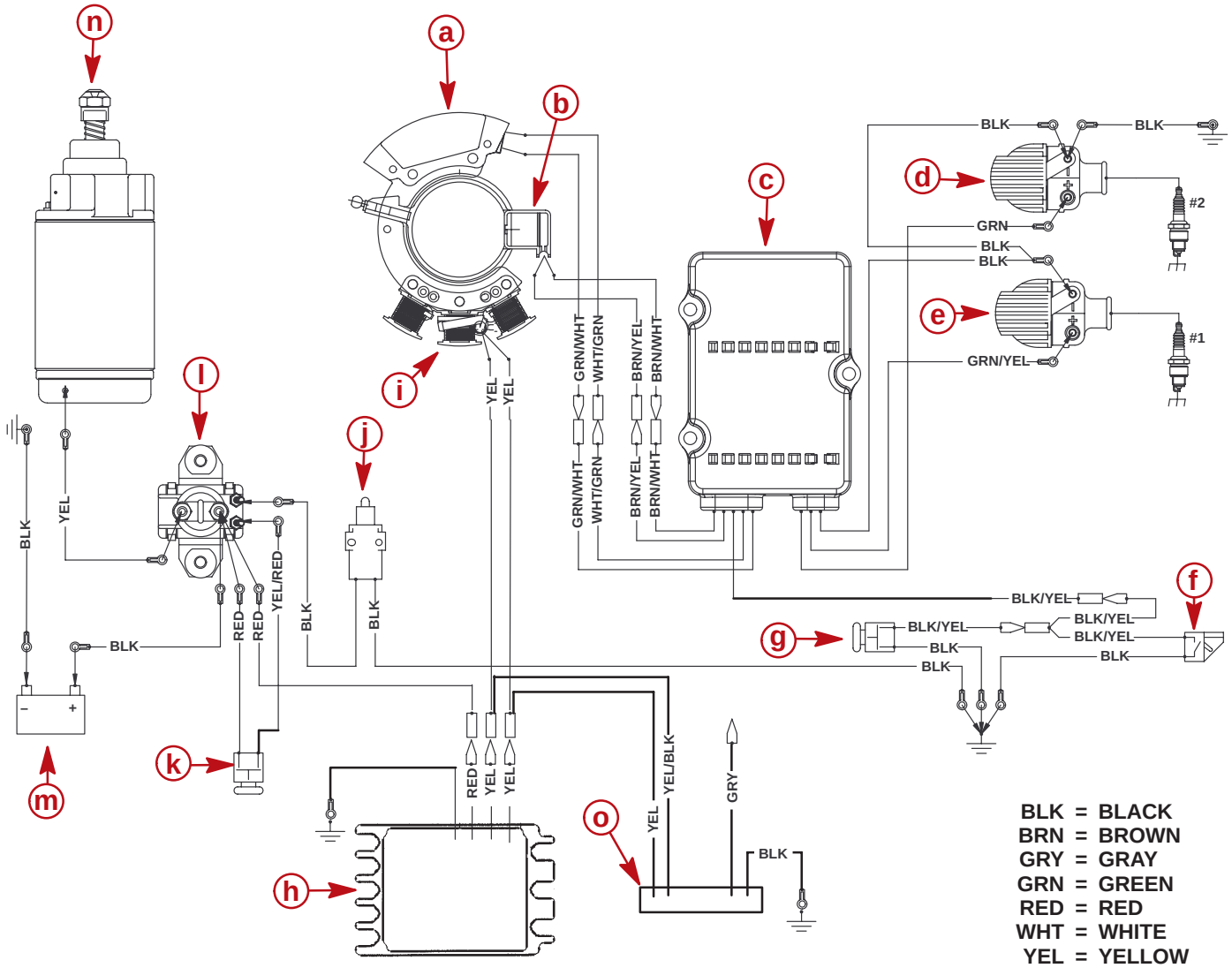
Electric Models Equipped with Remote Control (1999 And Newer, Design I)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

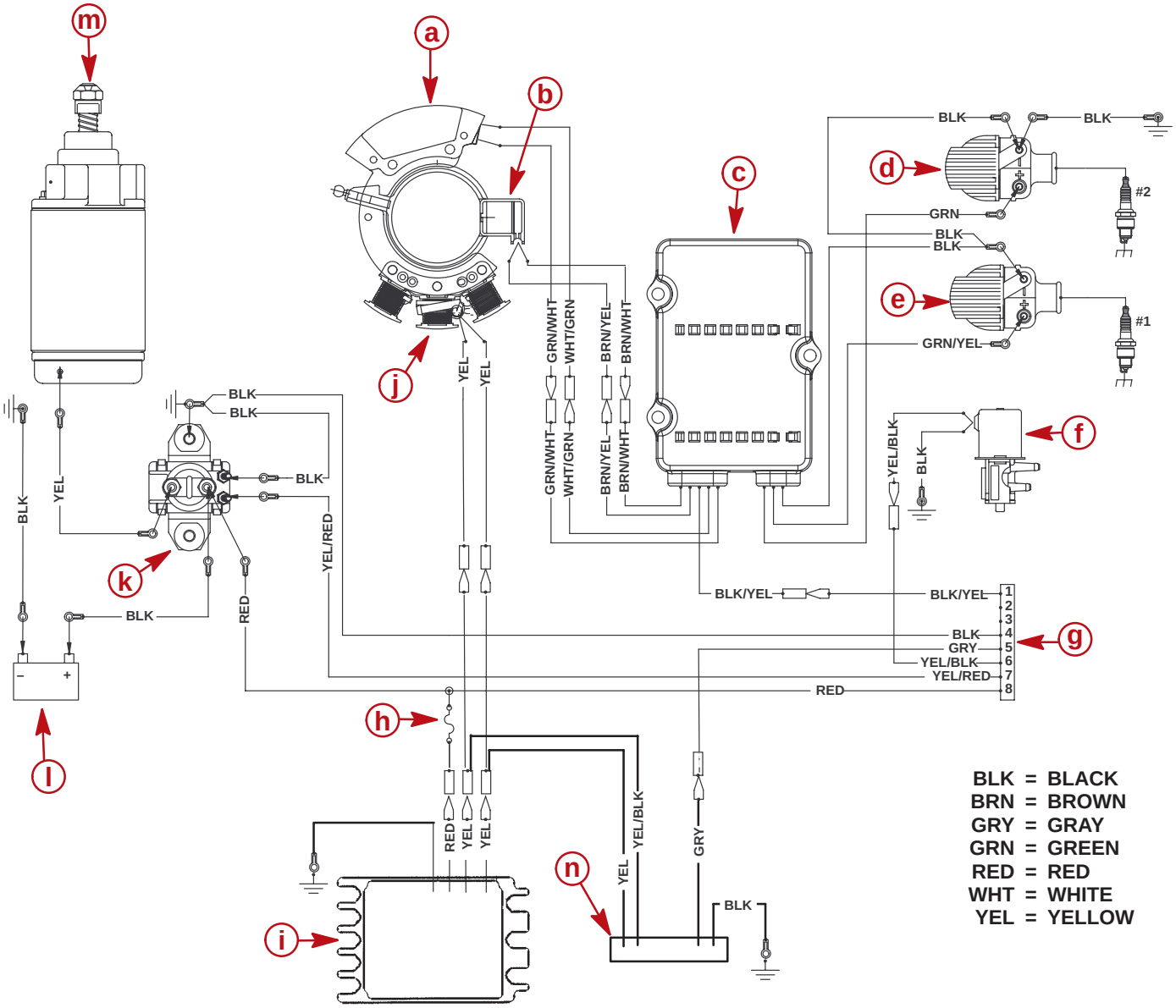
a - Stator
b - Trigger
c - Switch box
d - Ignition coil bottom cylinder
e - Ignition coil top cylinder
f - Choke solenoid
g - Remote control harness
h - Fuse holder (20 ampere fuse)
i - Rectifier
j - Alternator stator
k - Starter solenoid
l - 12 VDC battery
m - Starter motor

Electric Start Models with Tiller Handle Start Button (1999 And Newer, Design II)



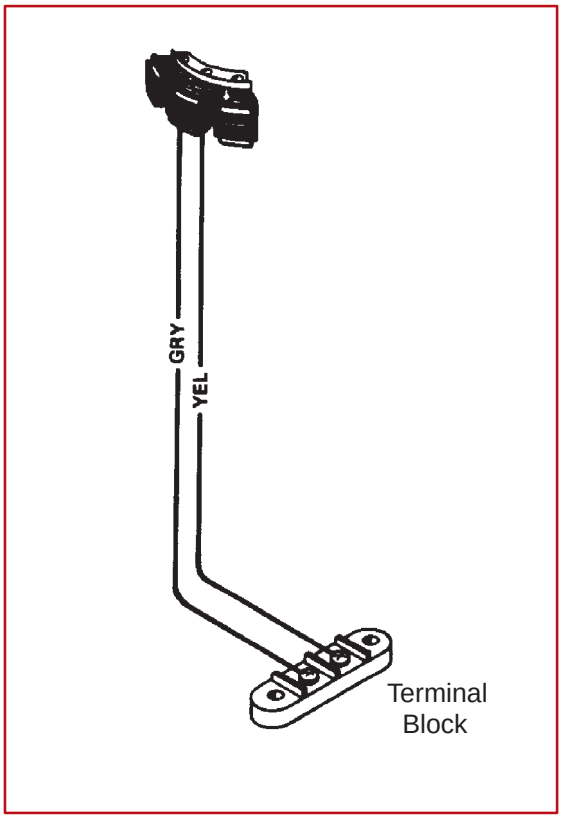
a - Stator
b - Trigger
c - Switch box
d - Ignition coil bottom cylinder
e - Ignition coil top cylinder
f - Emergency stop switch
g - Push button stop switch
h - Rectifier/Regulator
i - Alternator stator
j - Neutral start switch
k - Push button start switch
l - Start solenoid
m - 12 VDC battery
n - Starter motor
o - Tachometer module

Electric Models Equipped with Remote Control (1999 And Newer, Design II)

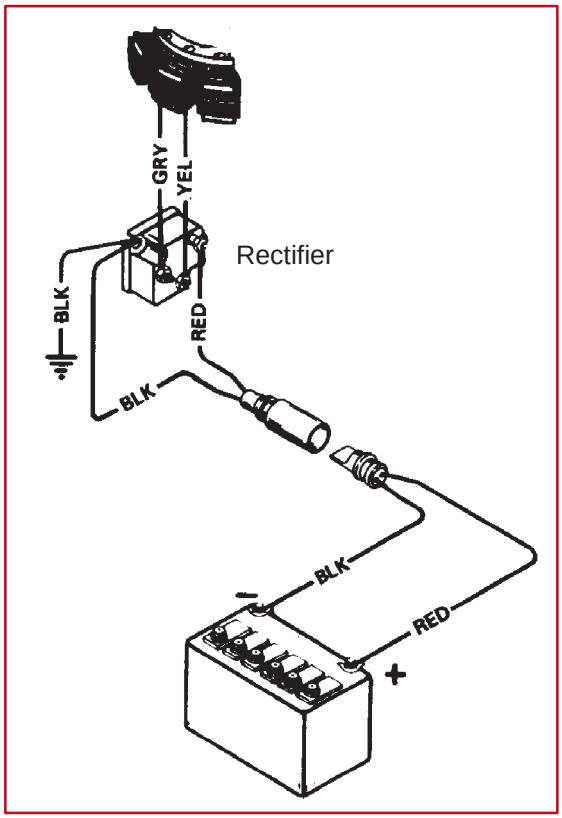


a - Stator
b - Trigger
c - Switch box
d - Ignition coil bottom cylinder
e - Ignition coil top cylider
f - Choke solenoid
g - Remote control harness
h - Fuse holder (20 ampere fuse)
i - Rectifier/Regulator
j - Alternator stator
k - Starter solenoid
l - 12 VDC battery
m - Starter motor
n - Tachometer module

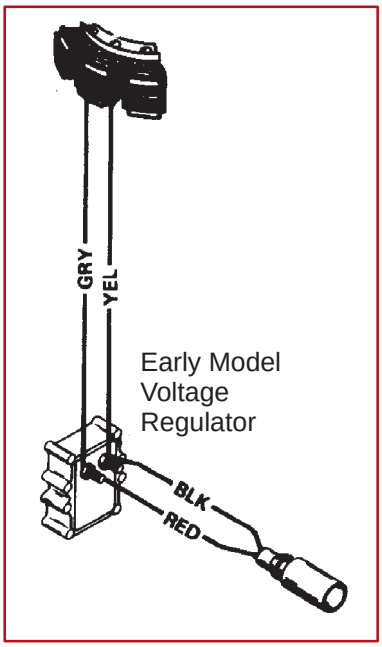
Optional Electrical Accessories Wiring Diagrams



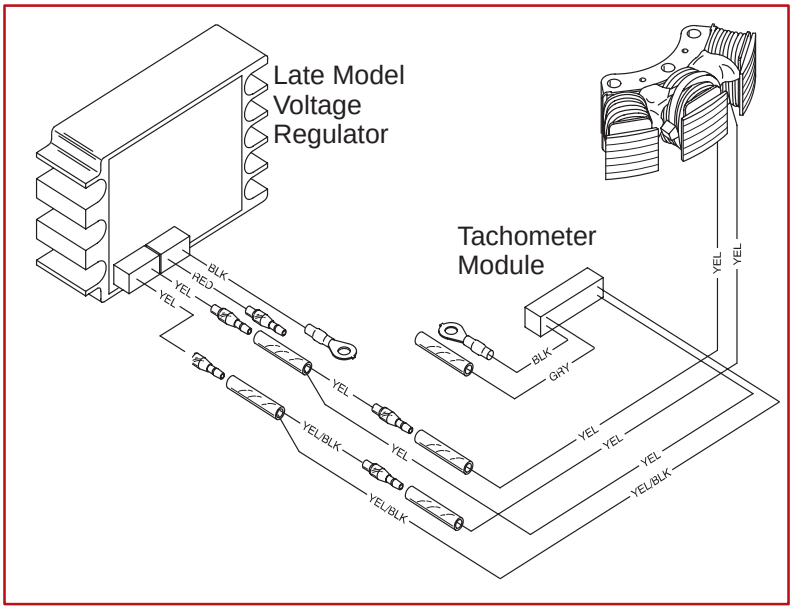
Manual Start Model with Lighting Coil and Unregulated AC Voltage



Manual Start Model with Battery Charging Kit

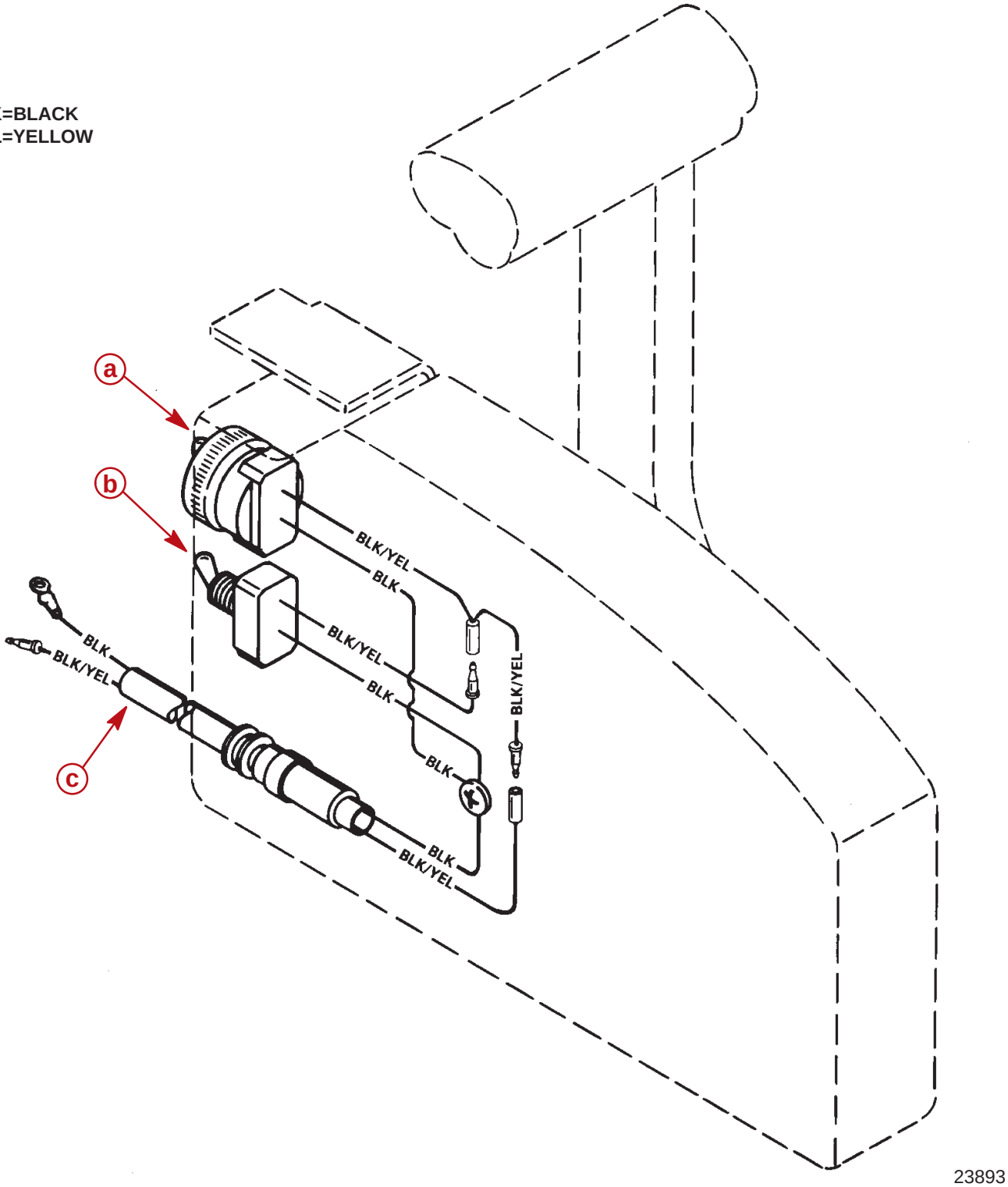


Manual Start Model with Voltage Regulator



Late Model Voltage Regulator with Tachometer Module

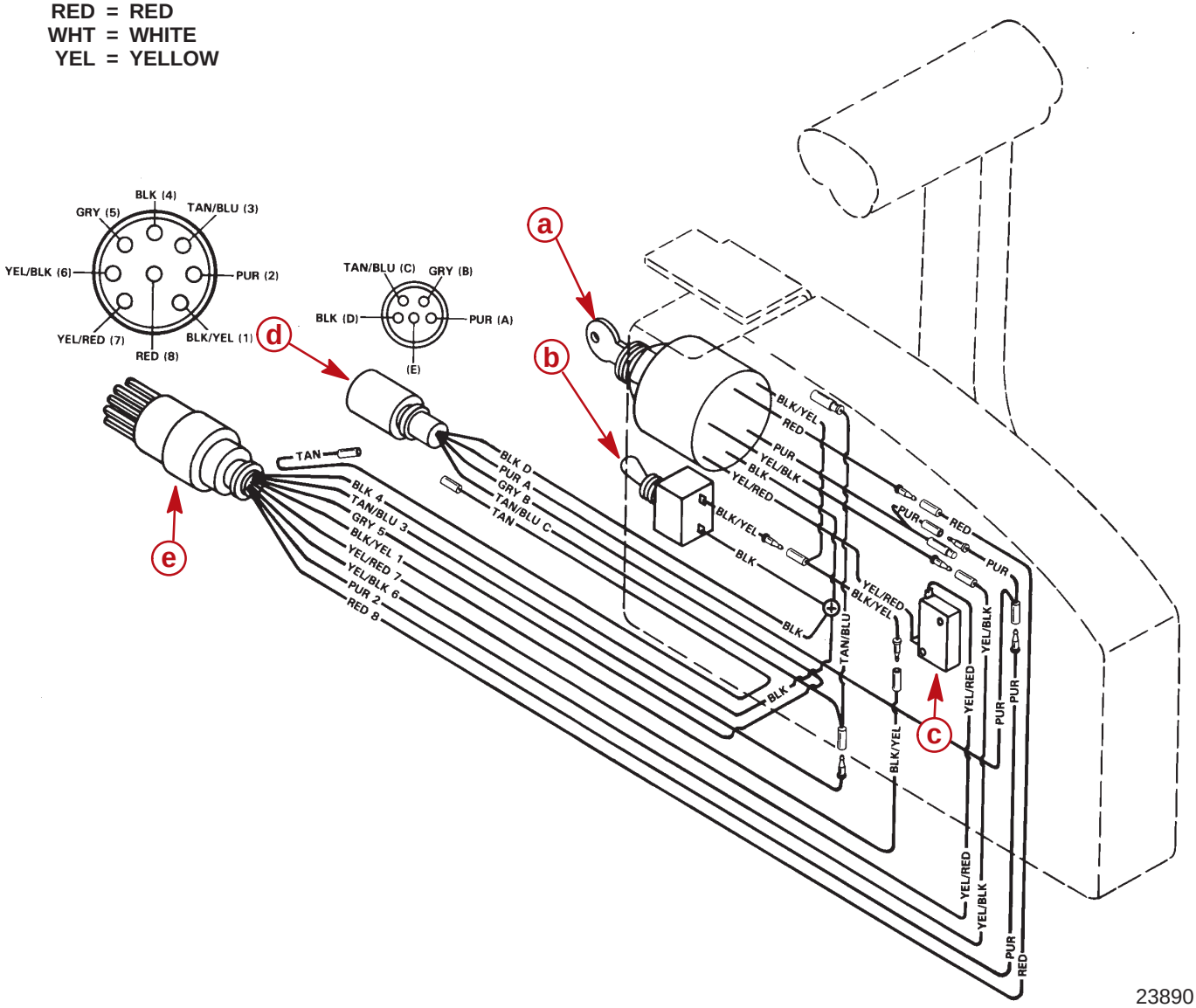
Commander 2000 Remote Control (Manual)



a - RUN – OFF switch
b - Emergency stop switch
c - Stop switch harness

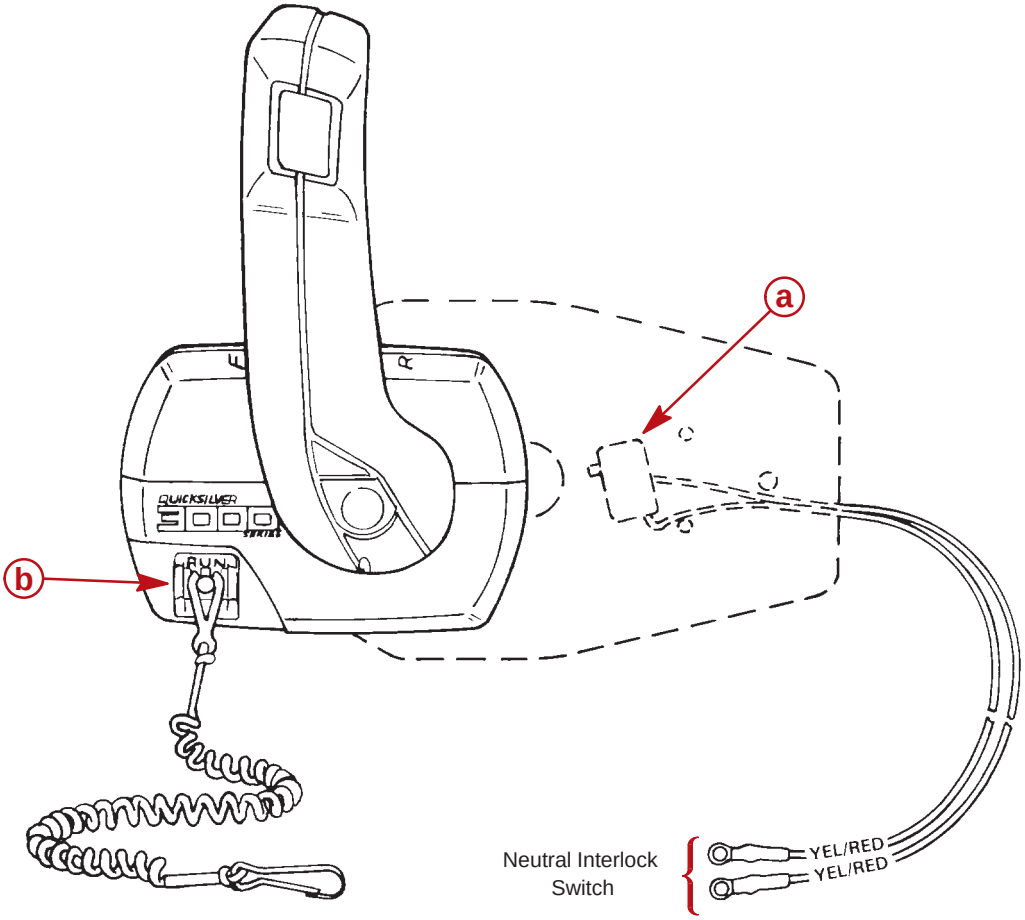
Commander 2000 Remote Control (Electric Start)

BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW



a - Ignition/Choke switch
b - Emergency stop switch
c - Neutral start switch
d - Tachometer/Accessories harness connector
e - Wiring harness connector

Commander 3000 Panel Mount Control



RED=RED
YEL=YELLOW

a - Neutral interlock switch
b - Emergency stop switch

FUEL SYSTEM

Section 3A – Fuel Delivery System

Table of Contents

Specifications 3A-2
WMC Carburetor Specifications 3A-3
Special Tools 3A-5
Carburetor Assembly (6 - 8)
(9.9 - USA–S/N-0G112449/BEL
–S/N-9831799 & Below) 3A-6
Carburetor Assembly (15) USA
–S/N-0G112449/BEL–S/N-9831799 & Below 3A-8
CARBURETOR ASSEMBLY USA
–S/N-0G112450 BEL–S/N-9831800 & Up . . 3A-10
Carburetor Assembly USA–S/N-0G112450/BEL
–S/N-9831800 & Up 3A-11
Fuel System Troubleshooting 3A-12
General Information 3A-12
Carburetor Removal 3A-14
Carburetor Installation 3A-15
Carburetor Adjustments 3A-17
Rejetting Carburetors for High Altitude . . 3A-22
Fuel Pump 3A-23
Removal and Disassembly 3A-23
Cleaning and Inspection 3A-23
Reassembly and Installation 3A-23
Primer System 3A-24
Servicing Sight Bowl Fuel Filter 3A-25

3
A

Specifications

Models 6/8/9.9/10/15		
CARBURETOR SPECIFICATIONS	**Type**	Center Bowl, Integral Fuel Pump
	Idle RPM (In Gear) –	
	6	650 ± 75
	8	725 ± 50
	9.9/9.9 Sailpower	725 ± 50
	10 Sea Pro/Marathon	850 ± 50
	XR/MAG/Viking10	725 ± 50
	15	725 ± 50
	Wide Open Throttle RPM	
	6	4000 – 5000
	8	4500 – 5500
	9.9/9.9 Sailpower	5000 – 6000
	10 Sea Pro/Marathon	5000 – 6000
	XR/MAG/Viking10	5000 – 6000
	15	5000 – 6000
	15 Sea Pro/Marathon	5000 – 6000
	Idle Mixture Screw (Initial Setting)	5000 – 6000
	Float Setting (All Models)	Refer to Section 3A
	Main Jet –	1 in. (25.4mm)
	Thread size	
		10–32
		1994 Model Year
	6	.042
	8	.046
	9.9/9.9 Sailpower	.052
	10 Sea Pro/Marathon	.064
	XR10/MAG10	.052
	15	.066
		1995 and Newer
	6	.042
	8	.046
	9.9/9.9 Sailpower	.048
	10 Sea Pro/Marathon	.052
	XR10/MAG10	052
	15/Viking10	.072
	15 Sea Pro/Marathon	.072

WMC Carburetor Specifications

1994

		MAIN JET				
MODEL	**CARB**	**0 – 5000 ft (0 – 1524m)**	**5000 – 7500 ft (1524 – 2286m)**	**7500 – 10000 ft (1524 – 3048m)**	**FLOAT LEVEL**	**IDLE MIX**
6	WMC-20B	.042	.040	.038	25.4mm (1 in.)	1-3/8 ± 1/4
8	WMC-18B	.046	.044	.042	25.4mm (1 in.)	1-3/8 ± 1/4
9.9	WMC-23	.052	.050	.048	25.4mm (1 in.)	1-3/8 ± 1/4
XR10 Mag 10	WMC-23	.052	.050	.048	25.4mm (1 in.)	1-3/8 ± 1/4
Seapro Marathon 10	WMC-42	.064	.062	.060	25.4mm (1 in.)	1-3/8 ± 1/4
15	WMC-73	.064	.062	.060	25.4mm (1 in.)	1-3/8 ± 1/4

1995 - 1996

		MAIN JET				
MODEL	**CARB**	**0 – 5000 ft (0 – 1524m)**	**5000 – 7500 ft (1524 – 2286m)**	**7500 – 10000 ft (1524 – 3048m)**	**FLOAT LEVEL**	**IDLE MIX**
6	WMC-20B	.042	.040	.038	25.4mm (1 in.)	1-3/8 ± 1/4
8	WMC-41	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-47	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-48	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50 WMC-50A	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-49	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4

WMC Carburetor Specifications

1997

		MAIN JET				
MODEL	CARB	0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)	FLOAT LEVEL	IDLE MIX
6	WMC-20B	.042	.040	.038	25.4mm (1 in.)	1-3/8 ± 1/4
8	WMC-41	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-47	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-48	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50A	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-49	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15 Seapro Marathon	WMC-55	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4

1998 – 2001

		MAIN JET				
MODEL	CARB	0 – 5000 ft (0 – 1524m)	5000 – 7500 ft (1524 – 2286m)	7500 – 10000 ft (1524 – 3048m)	FLOAT LEVEL	IDLE MIX
6	WMC-57	.042	.040	.038	25.4mm (1 in.)	1-1/4 ± 1/4
8	WMC-41A	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-47A	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-48A	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50B	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-49A	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15 Seapro Marathon	WMC-55A	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4

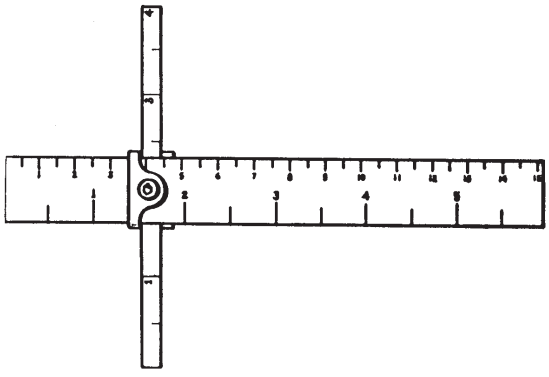
WMC Carburetor Specifications

2002 and UP

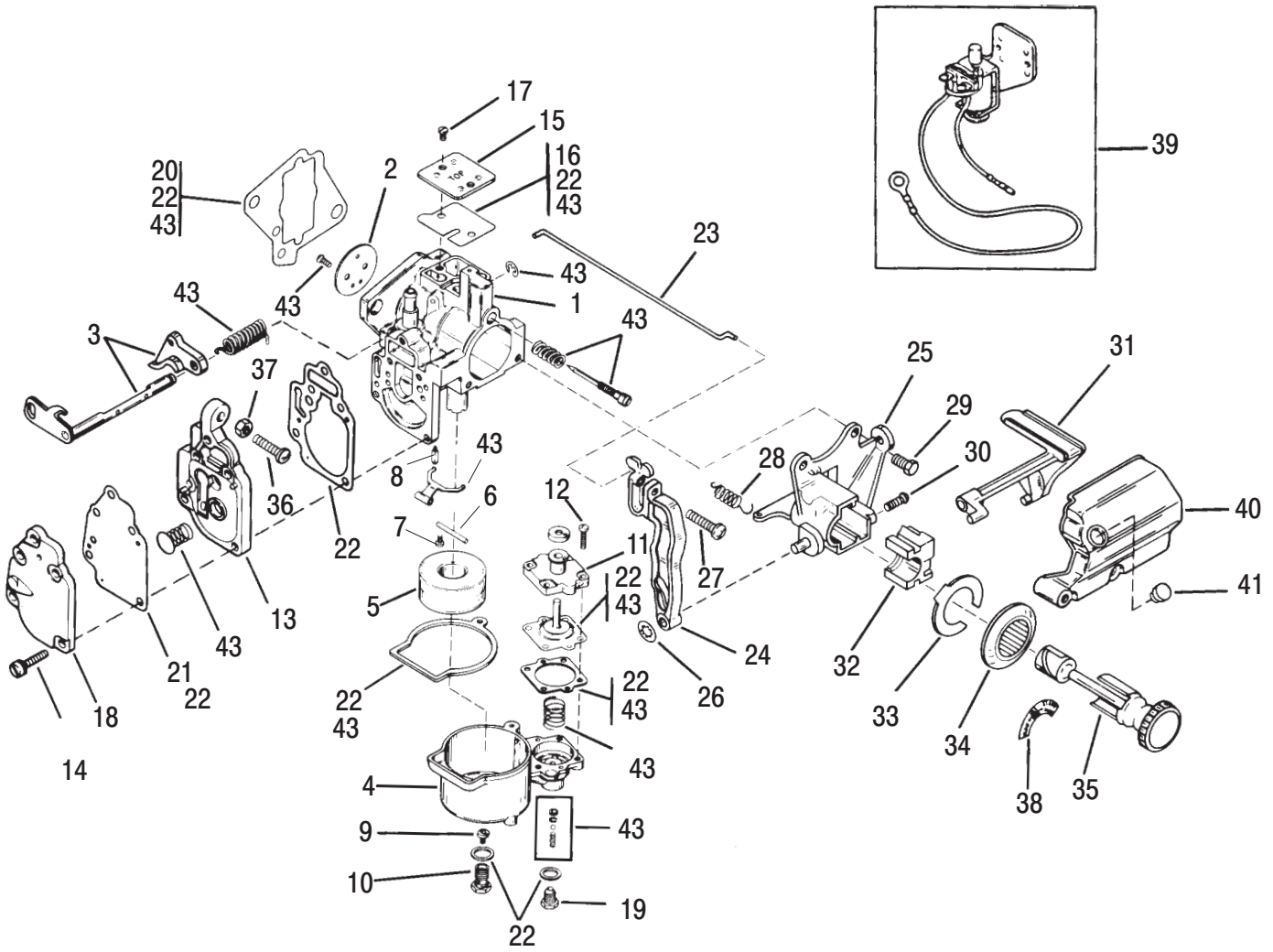
		MAIN JET				
MODEL	**CARB**	**0 – 5000 ft (0 – 1524m)**	**5000 – 7500 ft (1524 – 2286m)**	**7500 – 10000 ft (1524 – 3048m)**	**FLOAT LEVEL**	**IDLE MIX**
6	WMC-66	.042	.040	.038	25.4mm (1 in.)	1-1/4 ± 1/4
8	WMC-74	.046	.044	.042	25.4mm (1 in.)	1-1/2 ± 1/4
9.9	WMC-61	.048	.046	.044	25.4mm (1 in.)	1-1/2 ± 1/4
XR10 Mag 10	WMC-62	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
Seapro Marathon 10	WMC-50B	.052	.050	.048	25.4mm (1 in.)	1-1/2 ± 1/4
10 Viking	WMC-63	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15	WMC-77	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4
15 Seapro Marathon	WMC-55A	.072	.068	.066	25.4mm (1 in.)	1-1/2 ± 1/4

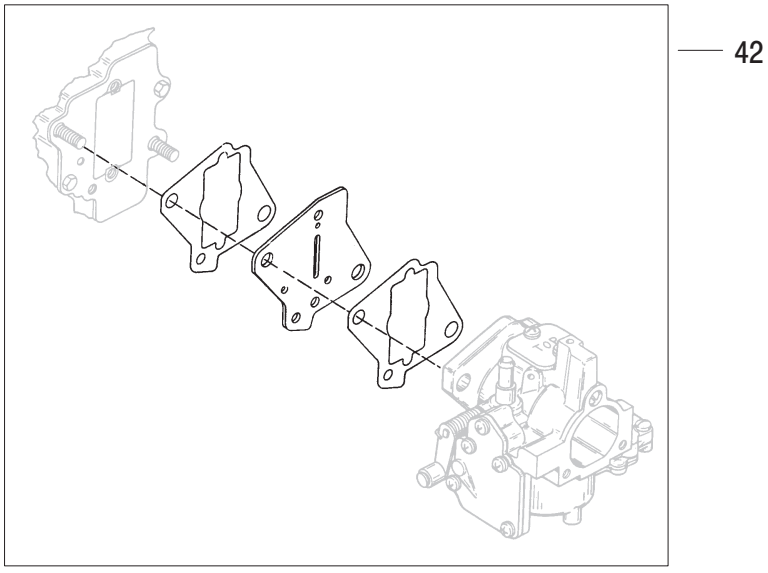
Special Tools

1. Carburetor Scale



Carburetor Assembly (6 - 8)
(9.9 - USA–S/N-0G112449/BEL–S/N-9831799 & Below)

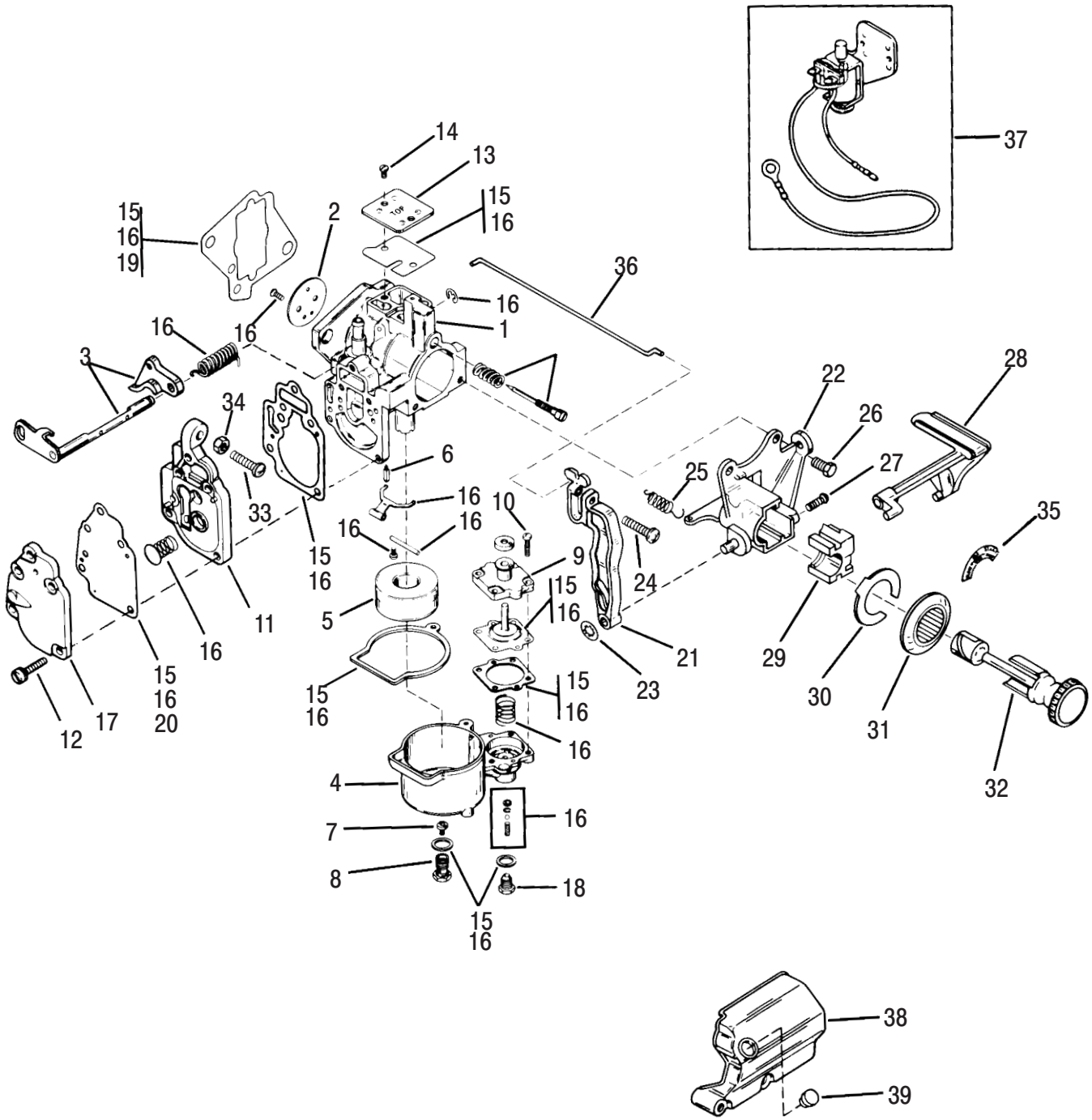




Carburetor Assembly (6 - 8)
(9.9 - USA–S/N-0G112449/BEL–S/N-9831799 & Below) (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CARBURETOR			
2	1	THROTTLE VALVE			
3	1	SHAFT			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	FLOAT PIN			
7	1	SCREW			
8	1	INLET NEEDLE VALVE			
9	1	MAIN FUEL JET			
10	1	PLUG–jet retainer	33		3.7
11	1	COVER–diaphragm			
12	4	SCREW	14		1.6
13	1	FUEL PUMP KIT			
14	5	SCREW–fuel pump	18		2.1
15	1	PLATE			
16	1	GASKET–electric choke			
17	2	SCREW	18		2.1
18	1	COVER–fuel pump			
19	1	PLUG	33		3.7
20	1	GASKET–carburetor (Use where applicable)			
21	1	DIAPHRAGM			
22	1	**GASKET/DIAPHRAGM KIT**			
23	1	IDLE WIRE			
24	1	FAST IDLE LEVER			
25	1	PRIMER BRACKET			
26	1	PUSHNUT			
27	1	SCREW			
28	1	SPRING			
29	2	SCREW (M5 x 8 x 12)	33		3.7
30	1	SCREW	Tighten Securely		
31	1	PRIMER LEVER			
32	1	CAM BLOCK			
33	1	RETAINING CLIP			
34	1	CHOKE BEZEL			
35	1	PRIMER KNOB			
36	1	SCREW			
37	1	NUT			
38	1	DECAL (SLOW/FAST)			
39	1	ELECTRIC CHOKE			
40	1	COVER			
41	1	PLUG			
42	1	**RESTRICTOR KIT**			
43	1	**REPAIR PARTS KIT**			

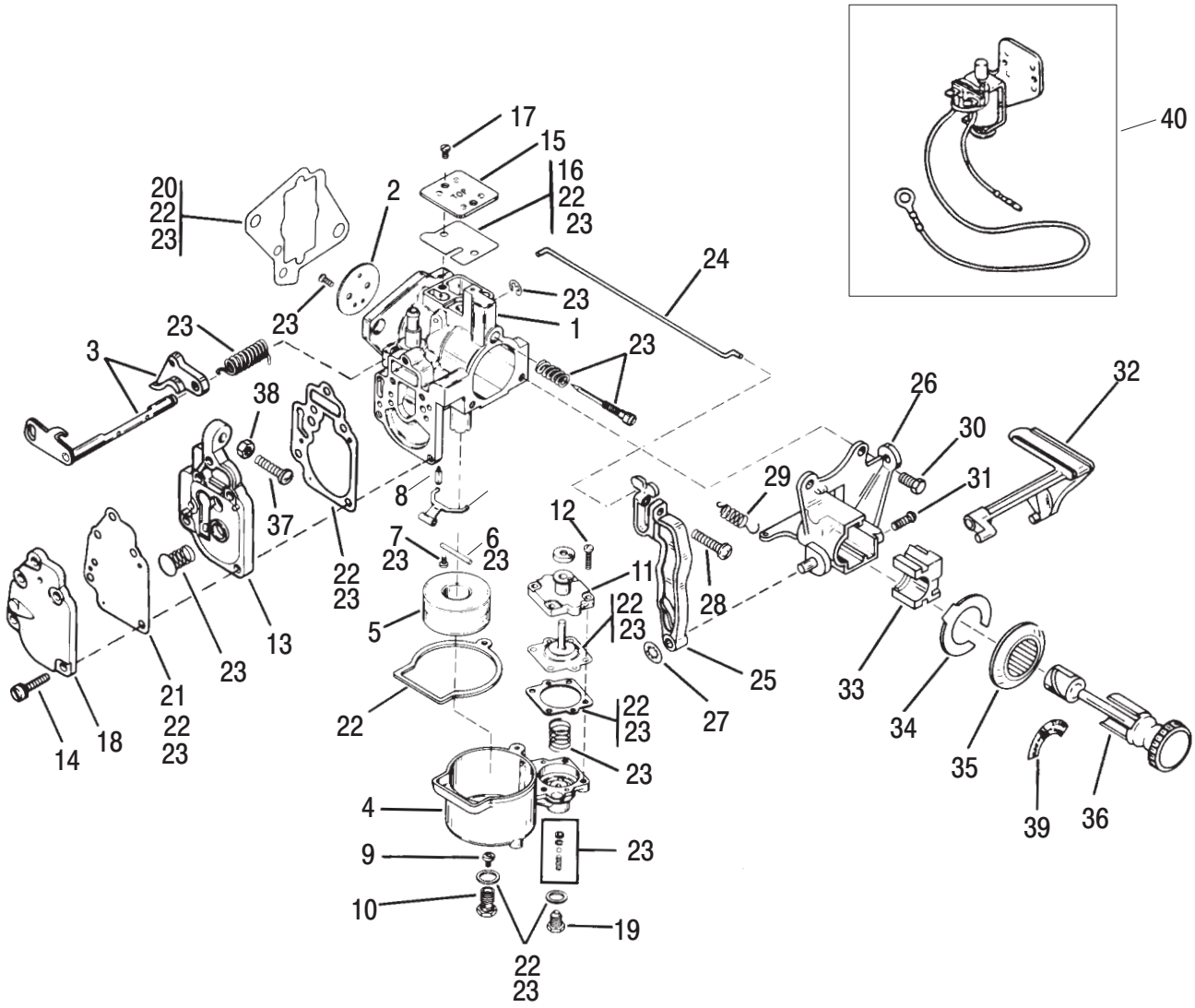
Carburetor Assembly (15)
USA–S/N-0G112449/BEL–S/N-9831799 & Below

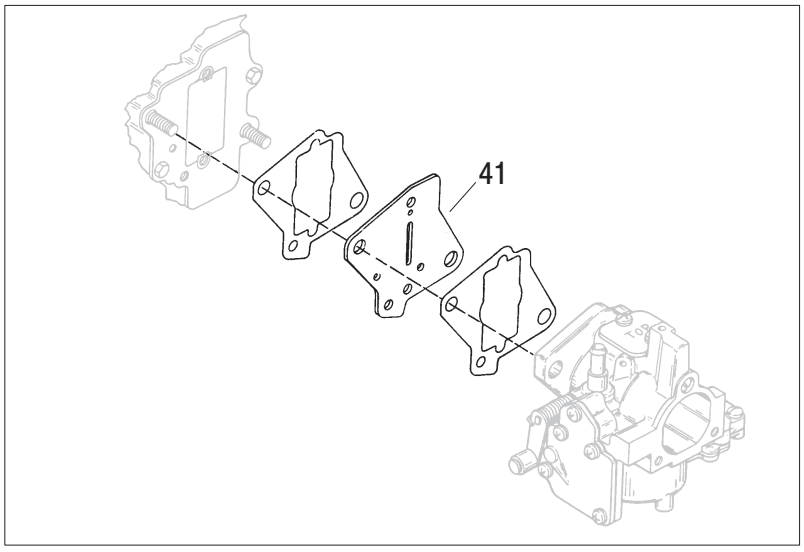


Carburetor Assembly (15)
USA–S/N-0G112449/BEL–S/N-9831799 & Below (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CARBURETOR **(WMC-73)**			
2	1	THROTTLE VALVE			
3	1	THROTTLE SHAFT (INCLS. SCREW & SPRING)			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	INLET NEEDLE VALVE			
7	1	MAIN FUEL JET (.066)			
8	1	PLUG–jet retainer	33		3.7
9	1	COVER–diaphragm			
10	4	SCREW–diaphragm cover	14		1.7
11	1	FUEL PUMP KIT			
12	5	SCREW–fuel pump cover	18		2.1
13	1	PLATE–cover			
14	2	SCREW–cover plate	18		2.1
15	1	GASKET/DIAPHRAGM KIT			
16	1	REPAIR PARTS KIT			
17	1	COVER–fuel pump			
18	1	PLUG	33		3.7
19	1	GASKET–carburetor			
20	1	DIAPHRAGM			
21	1	FAST IDLE LEVER			
22	1	PRIMER BRACKET			
23	1	PUSHNUT			
24	1	SCREW			
25	1	SPRING			
26	2	SCREW (M5 x 8 x 12)	33		3.7
27	1	SCREW	Tighten Securely		
28	1	PRIMER LEVER			
29	1	CAM BLOCK			
30	1	RETAINING CLIP			
31	1	CHOKE BEZEL			
32	1	PRIMER KNOB			
33	1	SCREW			
34	1	NUT			
35	1	DECAL (SLOW/FAST)			
36	1	IDLE WIRE			
37	1	ELECTRIC CHOKE			
38	1	COVER			
39	1	PLUG			

CARBURETOR ASSEMBLY
USA–S/N-0G112450/BEL–S/N-9831800 & Up





Carburetor Assembly
USA–S/N-0G112450/BEL–S/N-9831800 & Up (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CARBURETOR			
2	1	THROTTLE VALE			
3	1	SHAFT			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	FLOAT PIN			
7	1	SCREW			
8	1	INLET NEEDLE VALVE			
9	1	MAIN FUEL JET			
10	1	PLUG–jet retainer	33		3.7
11	1	COVER–diaphragm			
12	4	SCREW	14		1.6
13	1	FUEL PUMP KIT			
14	5	SCREW–fuel pump	18		2.1
15	1	PLATE			
16	1	GASKET			
17	2	SCREW	18		2.1
18	1	COVER-fuel pump			
19	1	PLUG	33		3.7
20	1	GASKET–carburetor			
21	1	DIAPHRAGM			
22	1	**GASKET/DIAPHRAGM KIT**			
23	1	**REPAIR PARTS KIT**			
24	1	IDLE WIRE			
25	1	FAST IDLE LEVER			
26	1	PRIMER BRACKET			
27	1	PUSHNUT			
28	1	SCREW (6-32 x 3/4)			
29	1	SPRING			
30	2	SCREW (M5 x 8 x 12)	33		3.7
31	1	SCREW (8-32 x 1/2)	Tighten Securely		
32	1	PRIMER LEVER			
33	1	CAM BLOCK			
34	1	RETAINING CLIP			
35	1	CHOKE BEZEL			
36	1	PRIMER KNOB			
37	1	SCREW (M5 x 30)			
38	1	NUT			
39	1	DECAL - Bezel Choke			
40	1	ELECTRIC CHOKE			
41	1	RESTRICTOR PLATE			

Fuel System Troubleshooting

General Information

Problems thought to be caused by the fuel system may be caused by one or more of the following six items listed below.

1. Propeller
2. Spark Plugs
3. Ignition Timing
4. Ignition Spark Voltage
5. Cylinder Compression
6. Reed Valves

Typical symptoms and solutions in troubleshooting a fuel system are shown below:

Problem: Engine Turns Over but Will Not Start or Starts Hard When Cold **Problem: Engine Idles Rough and Stalls.** **Problem: Engine Runs Uneven or Surges.** **Problem: Engine Will Not Accelerate.**	
Possible Cause	**Corrective Action**
Improper starting procedure used.	Review starting procedure as outlined in Operation and Maintenance Manual.
Fuel tank empty or too low. Improperly mixed fuel. Contaminants (water,dirt, etc.) in fuel.	Check fuel in tank and replace or add whichever is necessary.
Fuel tank air vent closed or restricted.	Check air vent on fuel tank. Air vent must be open all the way and free from any contaminants.
Pinched, cut, restricted fuel line or loose fuel line connection.	Inspect all fuel lines and replace as needed. Tighten fuel line connections.
Dirty or restricted fuel filter.	Inspect and replace or clean all fuel filters.
Choke solenoid or enrichment valve not operating.	Inspect solenoid or valve and wiring. Replace as required.
Needle and seat in carburetor that is either stuck open (flooding) or closed (no fuel).	Refer to carburetor disassembly in this section.
Improper carburetor jet, restricted jet or idle mixture screw out of adjustment.	Refer to carburetor adjustments in this section.
Improper float level.	Refer to carburetor adjustments in this section.
Low fuel pump pressure.	Disassemble and inspect fuel pump components.
Defective anti-siphon valve.	Inspect valve and/or test engine without valve in fuel system.

Possible Cause	Corrective Action
Improperly mixed fuel. Contaminants (water, dirt, etc.) in fuel.	Check fuel in tank and replace if necessary.
Carburetor loose on intake manifold.	Check tightness of carburetor nuts.
Reed block loose or gasket defective.	Using a pressure oil can, apply 2-cycle oil around reed block housing/crankcase housing matching surfaces and carburetor base. If engine RPM changes, tighten bolts/nuts or replace gaskets as required.
Improperly routed or restricted bleed hoses.	Refer to bleed hose routing in Powerhead section.
Damaged fuel pump diaphragm.	Disassemble and inspect fuel pump components.
Carburetor mixing chamber cover leaking air.	Tighten screws or replace gasket.
Off idle holes plugged.	Blow with compressed air.
Main nozzle or idle nozzle air bleed holes plugged.	Blow with compressed air.
Damaged reeds.	Refer to Section 4 for reed inspection.
Fuel pick-up outlet tube in fuel tank cracked.	Replace.
Wrong spark plug or improper spark plug gap.	Install correct plug or readjust gap.
Improper spark timing.	Reset timing to correct specifications.
Enrichener diaphragm leaking.	Replace diaphragm.

Problem: Engine Floods	
Possible Cause	**Corrective Action**
Dirt or debris are preventing inlet needle from seating.	Flush out inlet seat and clean inlet needle.
Worn inlet needle.	Replace.
Punctured float.	Replace.
Incorrect float setting.	Reset float.

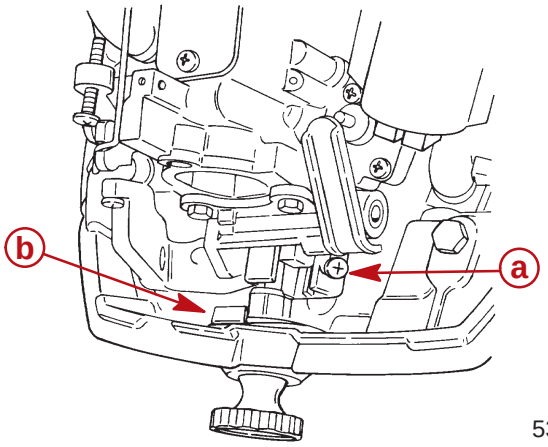
Problem: Engine Runs Too Rich	
Possible Cause	**Corrective Action**
Fuel level too high.	Reset float to correct level.
Carburetor floods.	See preceding Engine Floods.
Idle nozzle air holes plugged.	Blow out with compressed air.
Restricted air flow.	Inspect cowl air inlet and carburetor for obstructions.
Main fuel jet loose.	Retighten jet.

Problem: Fuel Blowback Out of Carburetor Problem: Unable to Reduce Engine RPM to Slow Idle	
Possible Cause	**Corrective Action**
Chipped or broken reeds on reed block.	Replace reeds.
Problem: Rough Idle	
Possible Cause	**Corrective Action**
Excessive preload on reeds.	Replace reeds.

Problem: Engine Runs Too Lean	
Possible Cause	**Corrective Action**
Carburetor is loose. Air leaks past mixing chamber cover.	Tighten bolts securely. Tighten cover or replace gasket.
Fuel level is too low.	Reset float level.
Clogged high speed jet.	Inspect jet for varnish or debris and clean.
Restricted fuel flow to carburetor.	Check fuel lines and filters for restricted flow.
Incorrect high speed jet.	Refer to main jet chart and replace with proper jet.
Idle mixture set too lean.	Adjust to run richer. Turn idle mix screw counterclockwise.
Air leakage into fuel system.	Inspect fuel line connections, hose clamps, fuel pump and fuel outlet tube (located in fuel tank) for loose fittings.
Anti-siphon valve restricting fuel flow.	Inspect valve and/or test engine without valve in fuel system.

Carburetor Removal

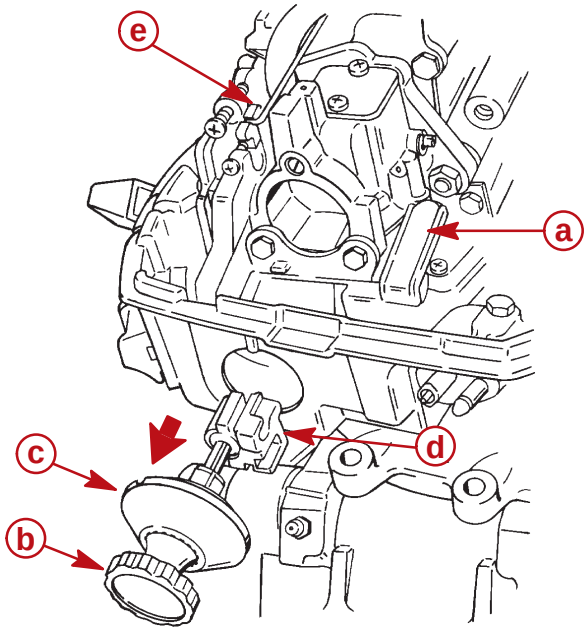
1. Loosen primer cam retaining screw.
2. Remove retaining clip.



53072

a - Screw
b - Retaining clip

3. Push down on primer arm and pull primer knob, bezel and slide block out of bottom cowl.
4. Remove link wire from fast idle lever.
5. Disconnect fuel line from carburetor.
6. Remove carburetor mounting nuts.
7. Lift carburetor from engine. Remove bleed line from fitting in bottom of carburetor.

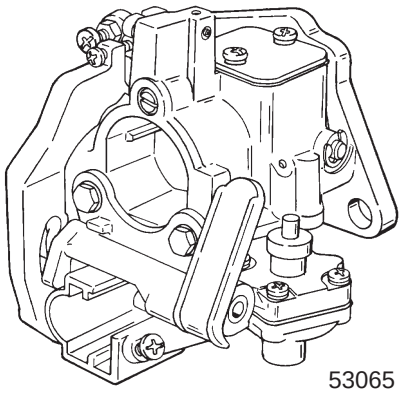


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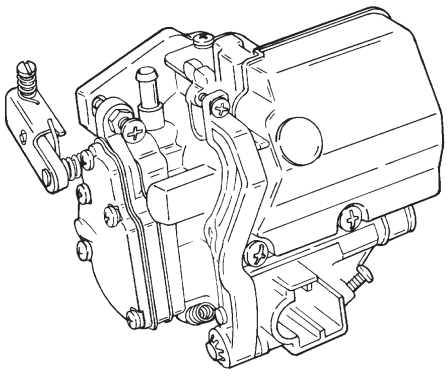
a - Primer arm
b - Primer knob
c - Bezel
d - Slide block
e - Link wire

Carburetor Installation

1. Install primer assembly components and air intake cover (on models so equipped) to carburetor.



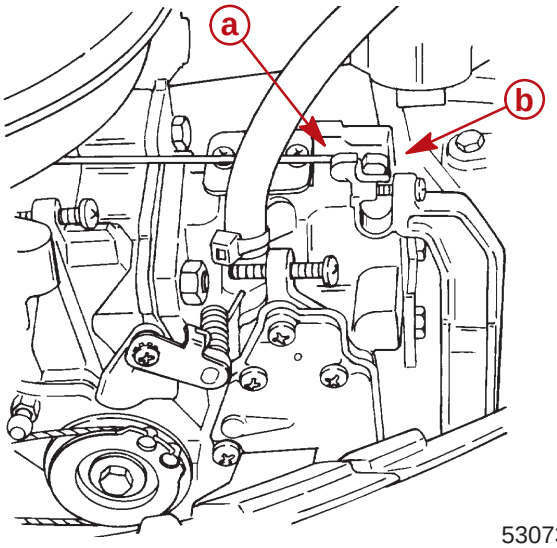
53065



53059

Model without Air Intake Cover	Models Equipped with Air Intake Cover

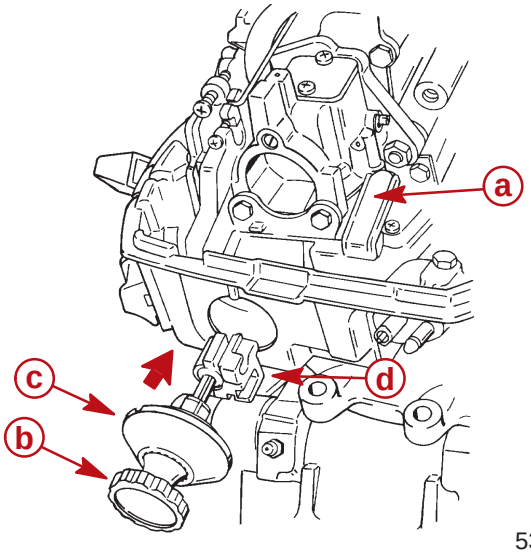
2. Reconnect bleed hose to fitting on carburetor and install carburetor and secure carburetor to engine with hex nuts.
3. Secure fuel line to carburetor with cable-tie.
4. Reconnect link wire to fast idle lever.



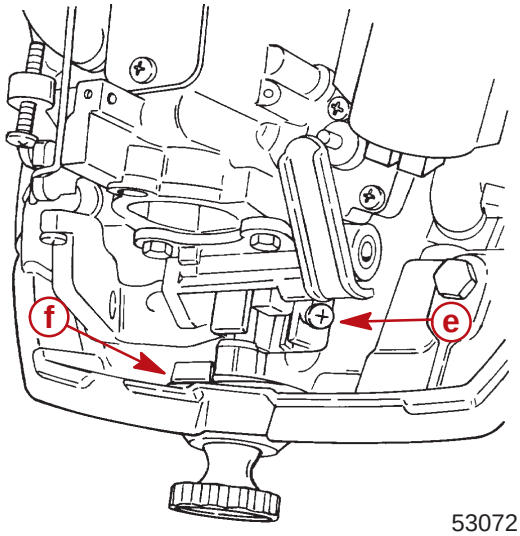
53073

a - Link wire
b - Fast idle lever

5. Push down on primer arm and insert primer knob, bezel and slide block into primer assembly.
6. Tighten screw to secure slide block in place.
7. Align notch in back side of bezel with tab on bottom cowl and secure bezel in place with retaining clip.



53071

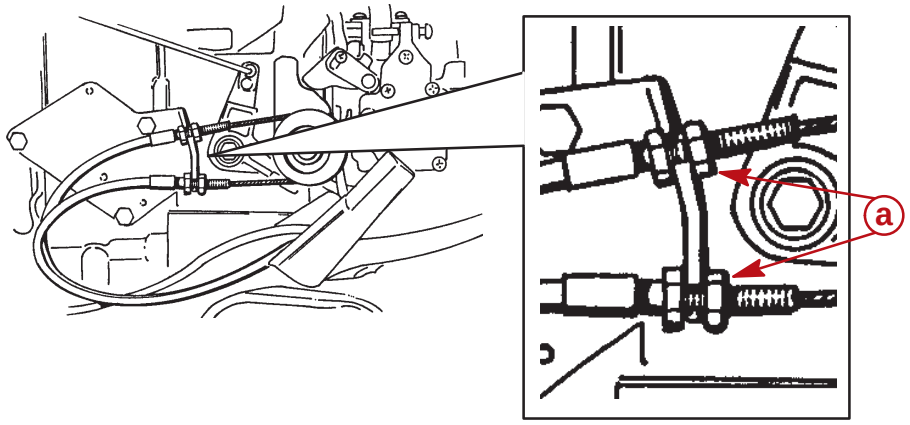


53072

a - Primer arm
b - Primer knob
c - Bezel
d - Slide block
e - Screw
f - Retaining clip

Carburetor Adjustments

1. Place outboard in water.
2. Check tiller handle cable adjustment for full throttle movement in both **Forward** and **Reverse** gears. Adjust jam nuts for proper travel and to eliminate any slack.

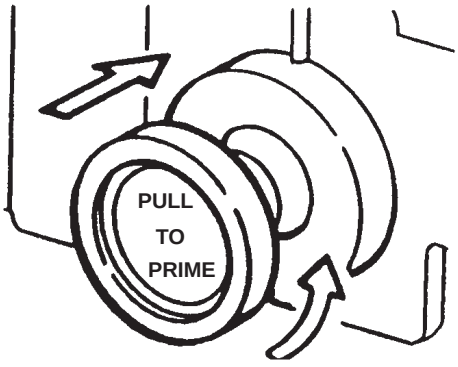


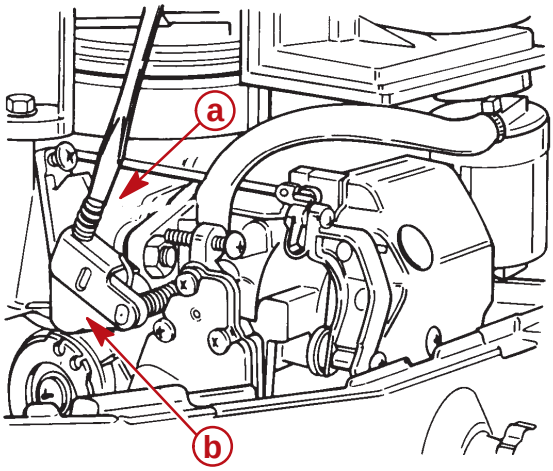
a - Adjustment jam nuts

INITIAL CARBURETOR ADJUSTMENTS

Idle Speed Screw (Models So Equipped)

1. Shift outboard to **Neutral** and place throttle twist grip to **Slow**.
2. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.
3. Back idle speed screw off of cam follower.
4. Turn idle speed screw clockwise until it just touches cam follower, then inward an additional 1/2 turn to slightly open throttle plate.

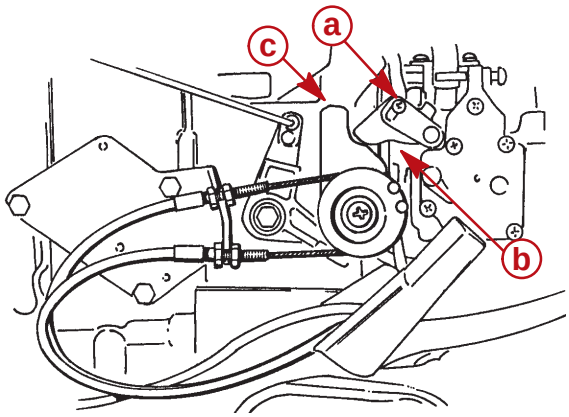




a - Idle speed screw
b - Cam follower

NOTE: *For Models NOT equipped with an idle speed screw:*

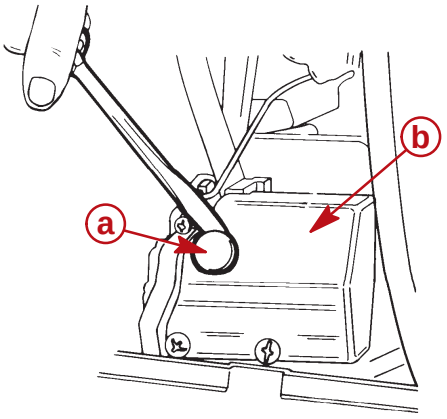
1. Loosen cam locking screw.
2. Press cam follower down until it contacts throttle cam.
3. Retighten cam locking screw.

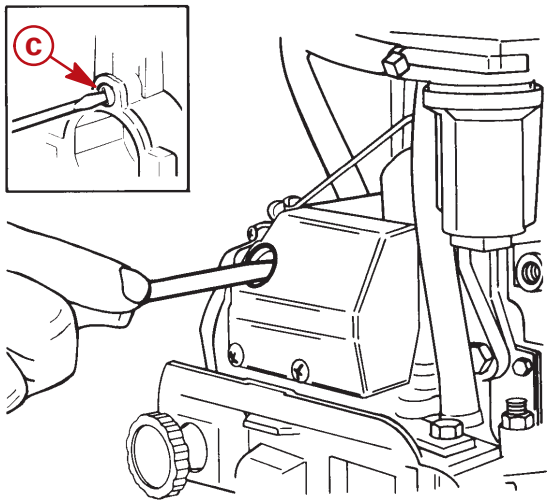


a - Cam locking screw
b - Cam follower
c - Throttle cam

LOW SPEED MIXTURE SCREW

1. Remove access plug from carburetor air intake cover.
2. Turn low speed mixture screw slowly clockwise until it seats lightly, then back screw out 1-1/2 to 1-3/8 turns. Turning mixture screw in tight will damage needle and seat.
3. Do not install access plug at this time.

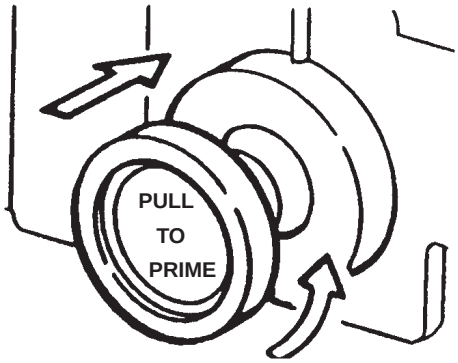


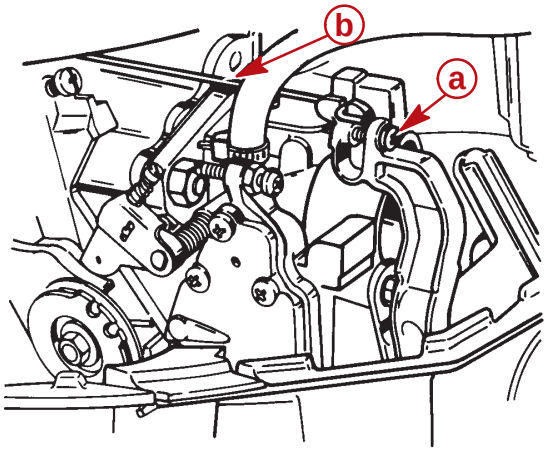


a - Plug
b - Air intake cover
c - Low speed mixture screw

IDLE WIRE ADJUSTMENT

1. Push primer/fast idle knob completely in and rotate fully counterclockwise.
2. Shift engine to **Neutral**.
3. Adjust screw to remove all clearance between idle wire and trigger.
4. Check fast idle speed by turning primer knob to full clockwise position. Fast idle speed should be 1500 - 2000 RPM.



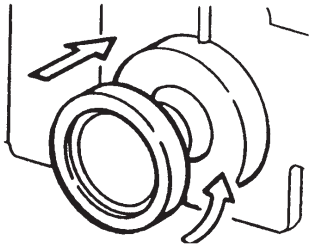


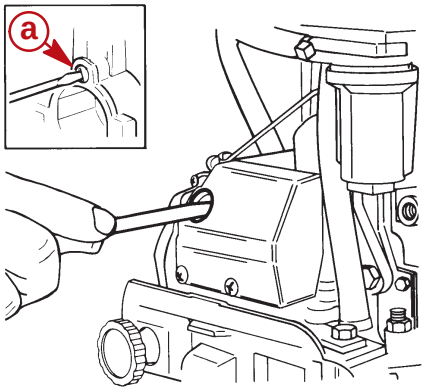
a - Adjustment screw
b - Idle wire

IDLE ADJUSTMENT

Low speed Mixture Adjustment

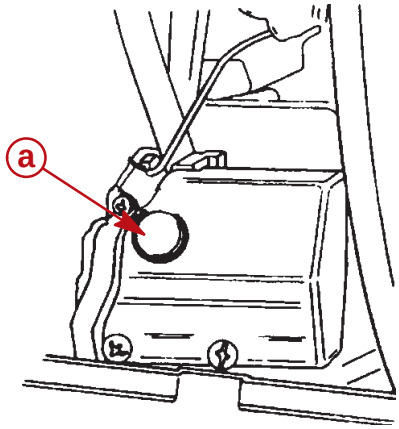
1. Start engine and allow to warm up (run for several minutes). Throttle engine back to idle for about one minute to allow RPM to stabilize.
2. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.
3. With engine running at idling speed while in **Forward** gear, turn low speed mixture screw counterclockwise until engine starts to load up from over-rich mixture.
4. Slowly turn low speed mixture screw clockwise until cylinders fire evenly and engine picks up speed.





a - Low speed mixture screw

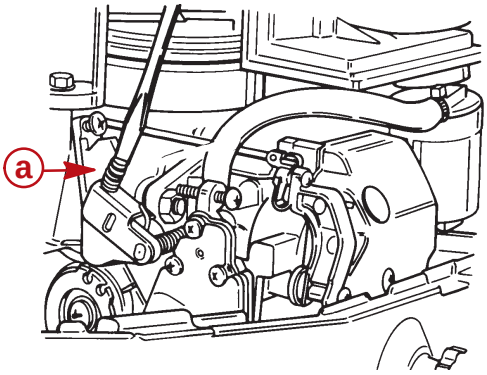
5. Continue turning mixture screw clockwise until too lean a mixture is obtained and engine slows down and misfires.
6. Set low speed mixture screw halfway between rich and lean.
7. DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, set mixture slightly richer rather than too lean.
8. Install access plug into opening in carburetor air intake cover.



a - Access plug

IDLE SPEED ADJUSTMENT (MODELS EQUIPPED WITH IDLE SCREW)

1. With engine running at idle in **Forward** gear, make sure primer/fast idle knob is pushed completely in and rotate fully counterclockwise to stop.
2. Adjust idle speed screw to obtain recommended idle speed. Refer to **Section 1A**.



a - Idle speed screw

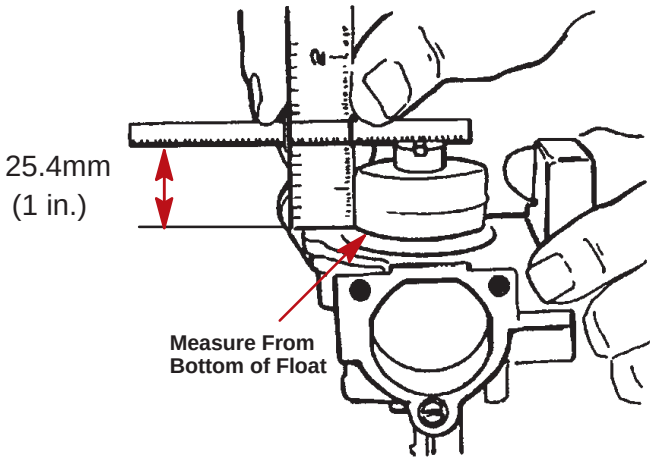
IDLE SPEED ADJUSTMENT (MODELS NOT EQUIPPED WITH AN IDLE SPEED SCREW)

For models not equipped with an idle speed screw, the carburetor has been calibrated at the factory to maintain an idle speed of 650 ± 75 RPM in **Forward** gear.

CARBURETOR FLOAT ADJUSTMENT

Check float level by removing fuel bowl and checking level of float as shown.

If necessary, adjust float level by bending float hinge.



JET ORIFICE SIZE/PART NUMBER CHART

NOTE: *Thread size for jets is 10-32.*

JET ORIFICE SIZE/PART NUMBER CHART			
Jet Orifice Size (Inch)	**Part Number**	**Jet Orifice Size (Inch)**	**Part Number**
.040	19266040	.058	1395-7831
.042	1399-5315	.060	1395-6487
.044	1395-7394	.062	1399-4217
.046	1399-5317	.064	1399-4216
.048	1395-6246	.066	1399-4215
.050	1395-6028	.068	1395-6029
.052	1395-6359	.070	1395-6030
.054	1399-5225	.072	1395-6207
.056	1399-5213	.074	1399-3794
.076	1399-3796	.094	1395-8423
.078	1395-6680	.096	1399-6249
.080	1395-6201	.098	1395-7335
.082	1399-3518		
.084	1399-3517		
.086	1395-5815		
.088	1395-6202		
.090	1395-6247		
.092	1395-5733		

Rejetting Carburetors for High Altitude

Factory installed main fuel jets are normally adequate for proper performance up to approximately 1524m (5000 ft) above sea level. Between 609.6m (2000 ft) and 1524m (5000 ft) the reduction of the main fuel jets may result in improved performance and fuel economy. Above 1524m (5000 ft), however, it is recommended that main jet size be reduced as shown per 304.8m (1000 ft) in the following chart. RETURN TO LOWER ELEVATION: Carburetor jet changes must be reversed to avoid a lean fuel condition when used at low elevation.

Feet Meter	1000 304.8	2000 609.6	3000 914.4	4000 1219.2	5000 1524	6000 1828.8	7000 2133.6	8000 2438.4	9000 2743.2	10000 3048	1100033 52.8	12000 3657.6
Jet Size												
0.034	0.034	0.034	0.032	0.032	0.032	0.032	0.032	0.032	0.030	0.030	0.030	0.030
0.036	0.036	0.036	0.034	0.034	0.034	0.034	0.034	0.032	0.032	0.032	0.032	0.032
0.038	0.038	0.038	0.036	0.036	0.036	0.036	0.036	0.034	0.034	0.034	0.034	0.034
0.040	0.040	0.040	0.038	0.038	0.038	0.038	0.038	0.036	0.036	0.036	0.036	0.034
0.042	0.042	0.042	0.040	0.040	0.040	0.040	0.038	0.038	0.038	0.038	0.038	0.036
0.044	0.044	0.044	0.042	0.042	0.042	0.042	0.040	0.040	0.040	0.040	0.038	0.038
0.046	0.046	0.046	0.044	0.044	0.044	0.044	0.042	0.042	0.042	0.042	0.040	0.040
0.048	0.048	0.048	0.046	0.046	0.046	0.046	0.044	0.044	0.044	0.042	0.042	0.042
0.050	0.050	0.050	0.048	0.048	0.048	0.046	0.046	0.046	0.046	0.044	0.044	0.044
0.052	0.052	0.050	0.050	0.050	0.050	0.048	0.048	0.048	0.048	0.046	0.046	0.046
0.054	0.054	0.052	0.052	0.052	0.052	0.050	0.050	0.050	0.048	0.048	0.048	0.048
0.056	0.056	0.054	0.054	0.054	0.054	0.052	0.052	0.052	0.050	0.050	0.050	0.048
0.058	0.058	0.056	0.056	0.056	0.056	0.054	0.054	0.054	0.052	0.052	0.052	0.050
0.060	0.060	0.058	0.058	0.058	0.056	0.056	0.056	0.054	0.054	0.054	0.052	0.052
0.062	0.062	0.060	0.060	0.060	0.058	0.058	0.058	0.056	0.056	0.056	0.054	0.054
0.064	0.064	0.062	0.062	0.062	0.060	0.060	0.060	0.058	0.058	0.058	0.056	0.056
0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.062	0.060	0.060	0.060	0.058	0.058
0.068	0.068	0.066	0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.060	0.060	0.060
0.070	0.070	0.068	0.068	0.068	0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.062
0.072	0.072	0.070	0.070	0.070	0.068	0.068	0.066	0.066	0.066	0.064	0.064	0.062
0.074	0.074	0.072	0.072	0.070	0.070	0.070	0.068	0.068	0.068	0.066	0.066	0.064
0.076	0.076	0.074	0.074	0.072	0.072	0.072	0.070	0.070	0.068	0.068	0.068	0.066
0.078	0.078	0.076	0.076	0.074	0.074	0.074	0.072	0.072	0.070	0.070	0.068	0.068
0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074	0.072	0.072	0.070	0.070
0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074	0.072	0.072
0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074
0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.074
0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076
0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078
0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080
0.094	0.094	0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082
0.096	0.096	0.094	0.094	0.092	0.092	0.090	0.090	0.088	0.086	0.086	0.084	0.084
0.098	0.098	0.096	0.096	0.094	0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086

Fuel Pump

Removal and Disassembly

IMPORTANT: Fuel pump check valve diaphragm and gasket should NOT be re-used once the fuel pump is disassembled.

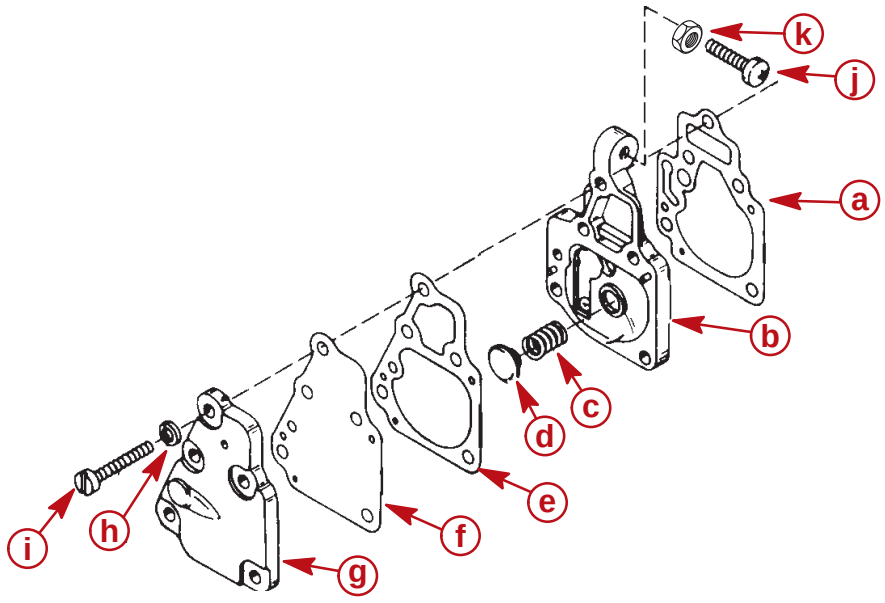
1. Remove 5 screws securing fuel pump assembly to carburetor.
2. Separate fuel pump components.

Cleaning and Inspection

1. Clean and dry all parts thoroughly.
2. Inspect pump body and base on carburetor for nicks, cracks or rough gasket surface.
3. Inspect pump check valve diaphragm. Diaphragm MUST BE flat and free from holes and imperfections.
4. Pump body surface below check valves MUST BE flat so that check valve will seat.

Reassembly and Installation

1. Inspect all parts for serviceability.
2. Reassemble fuel pump.
3. Secure fuel pump assembly to carburetor with 5 screws. Torque screws to 3.2 Nm (18 lb-in.).



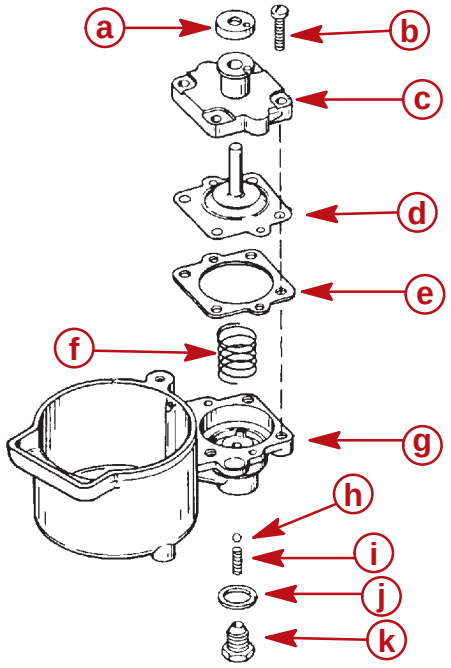
a - Gasket
b - Pump body
c - Spring
d - Cap
e - Gasket
f - Diaphragm
g - Pump cover
h - Lock washer (5)
i - Screw (5) [Torque screws to 3.2 Nm (18 lb-in.)]
j - Maximum spark advance screw
k - Nut

Primer System

The primer system provides extra fuel to the outboard whenever the primer knob is pulled out. The primer system components should be inspected carefully for serviceability. The diaphragm and gaskets should be inspected for cuts or abrasions. Replace accordingly. The primer check ball and springs should be inspected for debris, varnish or rust which restrict free movement.

SYMPTOMS OF A DEFECTIVE PRIMER SYSTEM

1. Outboard is hard to start.
   a. Diaphragm is cut.
   b. Primer check ball is stuck in the closed position.
   c. Primer passage is plugged with debris or varnish.
2. Outboard smokes excessively at idle.
   a. Primer check ball is not seated due to debris, varnish or damaged check ball spring.



a - Seal
b - Screw (4) [Torque to 1.6 Nm (14 lb-in.)]
c - Cover
d - Diaphragm
e - Gasket
f - Spring
g - Primer bowl
h - Check ball
i - Spring
j - Gasket
k - Plug

Servicing Sight Bowl Fuel Filter

⚠ WARNING

Exercise extreme caution when cleaning fuel filter elements. Gasoline is extremely flammable and highly explosive under certain conditions. Always stop the engine and DO NOT smoke or allow open flames in the area while cleaning fuel filter elements.

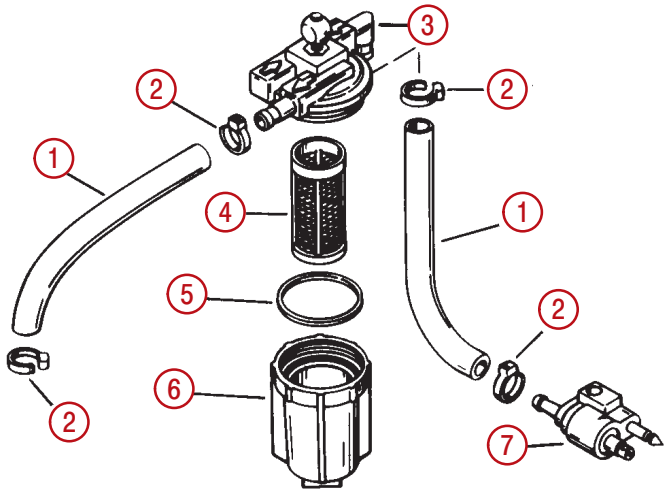
⚠ CAUTION

DO NOT turn or tilt fuel filter assembly when removing or installing. PULL STRAIGHT DOWN when removing assembly. PUSH STRAIGHT UP when installing assembly. Turning or tilting fuel filter may break fuel line connection on filter.

The sight bowl fuel filter removes dirt and water from the fuel.

Check the sight bowl frequently and clean the filter as required.

1. Verify that the sight bowl rubber sealing ring is properly positioned in the bowl.
2. Reinstall element in filter cover.
3. Thread sight bowl onto filter cover.
4. Tighten bowl securely by hand.



1 - Fuel Line
2 - Cable-tie (4)
3 - Cover
4 - Filter
5 - Rubber sealing washer
6 - Sight bowl
7 - Fuel line connector

FUEL SYSTEM

Section 3B – Emissions

Table of Contents

Exhaust Emissions Standards 3B-1
What Are Emissions? 3B-1
Hydrocarbons – HC 3B-1
Carbon Monoxide – CO 3B-1
Oxides of Nitrogen - NOx 3B-2
Controlling Emissions 3B-2
Stoichiometric (14.7:1) Air/Fuel Ratio . . . 3B-2
Outboard Hydrocarbon Emissions Reductions 3B-2
Stratified vs. Homogenized Charge 3B-3
Homogenized Charge 3B-3
Stratified Charge 3B-4
Emissions Information 3B-4
Manufacturer's Responsibility: 3B-4
Dealer Responsibility: 3B-5
Owner Responsibility: 3B-5
EPA Emission Regulations: 3B-5
Service Replacement Certification Label . . . 3B-7
Removal 3B-7
Date Code Identification 3B-7
Installation 3B-8
Decal Location: 3B-8

Exhaust Emissions Standards

Through the Environmental Protection Agency (EPA), the federal government has established exhaust emissions standards for all new marine engines sold in the U.S.

What Are Emissions?

Emissions are what comes out of the exhaust system in the exhaust gas when the engine is running. They are formed as a result of the process of combustion or incomplete combustion. To understand exhaust gas emissions, remember that both air and fuel are made of several elements. Air contains oxygen and nitrogen among other elements; gasolene contains mainly hydrogen and carbon. These four elements combine chemically during combustion. If combustion were complete, the mixture of air and gasoline would result in these emissions: water, carbon dioxide and nitrogen, which are not harmful to the environment. But combustion is not usually complete. Also, potentially harmful gases can be formed during and after combustion.

All marine engines must reduce the emission of certain pollutants, or potentially harmful gases, in the exhaust to conform with levels legislated by the EPA. Emissions standards become more stringent each year. Standards are set primarily with regard to three emissions: hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOx).

Hydrocarbons – HC

Gasoline is a hydrocarbon fuel. The two elements of hydrogen and carbon are burned during combustion in combination with oxygen. But they are not totally consumed. Some pass through the combustion chamber and exit the exhaust system as unburned gases known as hydrocarbons.

Carbon Monoxide – CO

Carbon is one of the elements that make up the fuel burned in the engine along with oxygen during the combustion process. If the carbon in the gasoline could combine with enough oxygen (one carbon atom with two oxygen atoms), it would come out of the engine in the form of carbon dioxide (CO_2). CO_2 is a harmless gas. But carbon often combines with insufficient oxygen (one carbon atom with one oxygen atom). This forms carbon monoxide, CO. Carbon monoxide is the product of incomplete combustion and is a dangerous, potentially lethal gas.

Oxides of Nitrogen - NOx

NOx is a slightly different byproduct of combustion. Nitrogen is one of the elements that makes up the air going into the engine. Under extremely high temperatures it combines with oxygen to form oxides of nitrogen (NOx). This happens in the engine's combustion chambers when temperatures are too high. NOx itself is not harmful, but when exposed to sunlight it combines with unburned hydrocarbons to create the visible air pollutant known as smog. Smog is a serious problem in California as well as many other heavily populated areas of the United States.

Controlling Emissions

There are two principle methods of reducing emissions from a two stroke marine engine. The first method is to control the air/fuel ratio that goes into the combustion chamber. The second is to control the time when this air/fuel mixture enters the combustion chamber. Timing is important, to prevent any unburned mixture from escaping out of the exhaust port.

Stoichiometric (14.7:1) Air/Fuel Ratio

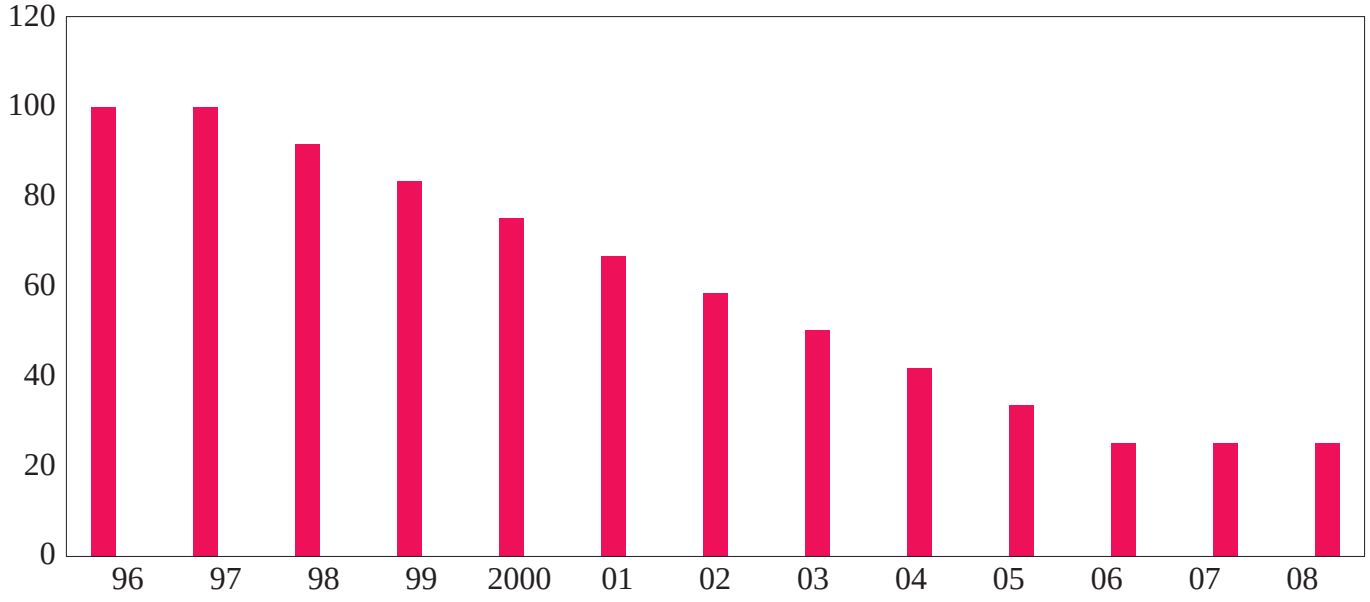
In the search to control pollutants and reduce exhaust emissions, engineers have discovered that they can be reduced effectively if a gasoline engine operates at an air/fuel ratio of 14.7:1. The technical term for this ideal ratio is stoichiometric. An air/fuel ratio of 14.7:1 provides the best control of all three elements in the exhaust under almost all conditions.

The HC and CO content of the exhaust gas is influenced significantly by the air/fuel ratio. At an air/fuel ratio leaner than 14.7:1, HC and CO levels are low, but with a ratio richer than 14.7:1 they rise rapidly. It would seem that controlling HC and CO by themselves might not be such a difficult task; the air/fuel ratio only needs to be kept leaner than 14.7:1. However, there is also NOx to consider.

As the air/fuel ratio becomes leaner, combustion temperatures increase. Higher combustion temperatures raise the NOx content of the exhaust. But, enrichening the air/fuel ratio to decrease combustion temperatures and reduce NOx also increases HC and CO, as well as lowering fuel economy. So the solution to controlling NOx - as well as HC and CO - is to keep the air/fuel ratio as close to 14.7:1 as possible.

Outboard Hydrocarbon Emissions Reductions

8-1/3% ↓ Per Year Over 9 Model Years



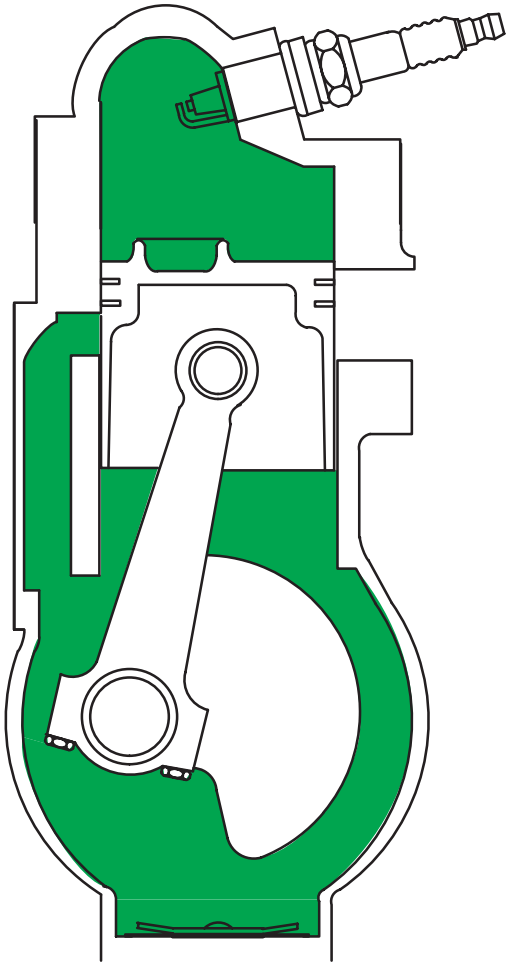
Stratified vs. Homogenized Charge

DFI engines use a stratified charge inside the combustion chamber to aid in reducing emissions. All other models use a homogenized charge. The difference between the two is:

Homogenized Charge

A homogenized charge has the fuel/air particles mixed evenly throughout the cylinder. This mixing occurs inside the carburetor venturi, reed blocks and crankcase. Additional mixing occurs as the fuel is forced through the transfer system into the cylinder.

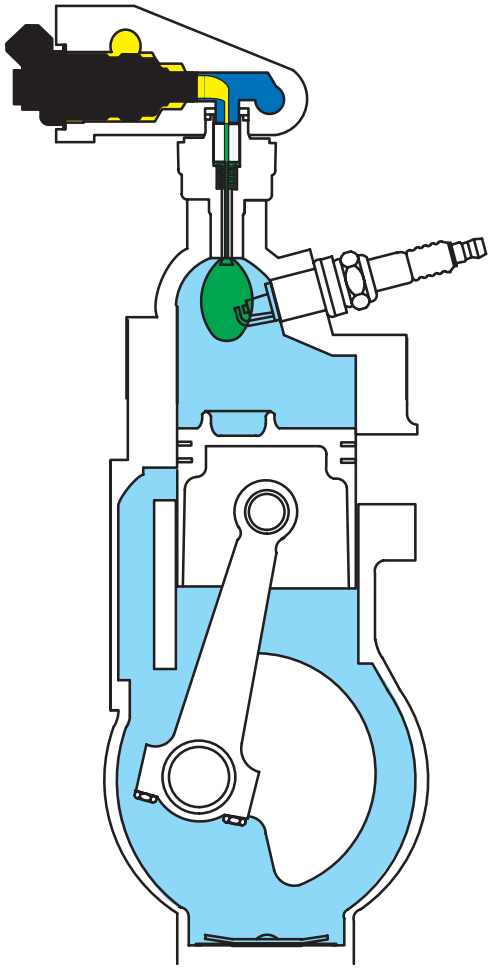
The homogenized charge is easy to ignite as the air/fuel ratio is approximately 14.7:1.



Stratified Charge

A stratified charge engine only pulls air through the transfer system. The fuel required for combustion is forced into the cylinder through an injector placed in the top of the cylinder (head). The injector sprays a fuel/air mixture in the form of a bubble into the cylinder. Surrounding this bubble is air supplied by the transfer system. As the bubble is ignited and burns, the surrounding air provides almost complete combustion before the exhaust port opens.

A stratified charge is hard to ignite, the fuel/air bubble is not evenly mixed at 14.7:1 and not easily ignited.



Emissions Information

Manufacturer’s Responsibility:

Beginning with 1998 model year engines, manufacturers of all marine propulsion engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States Environmental Protection Agency (EPA). A certification decal/emissions control information label, showing emission levels and engine specifications directly related to emissions, **must** be placed on each engine at the time of manufacture.

Dealer Responsibility:

When performing service on all 1998 and later outboards that carry a certification, attention must be given to any adjustments that are made that affect emission levels.

Adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are **not** to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturers prescribed changes, such as that for altitude adjustments.

Owner Responsibility:

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

The owner/operator is **not** to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

Single engine exceptions may be allowed with permission from the EPA for racing and testing.

EPA Emission Regulations:

All new 1998 and later outboards manufactured by Mercury Marine are certified to the United States Environmental Protection Agency as conforming to the requirements of the regulations for the control of air pollution from new outboard motors. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA laws on exhaust emissions for marine products. For more detailed information on this subject, you may contact the following locations:

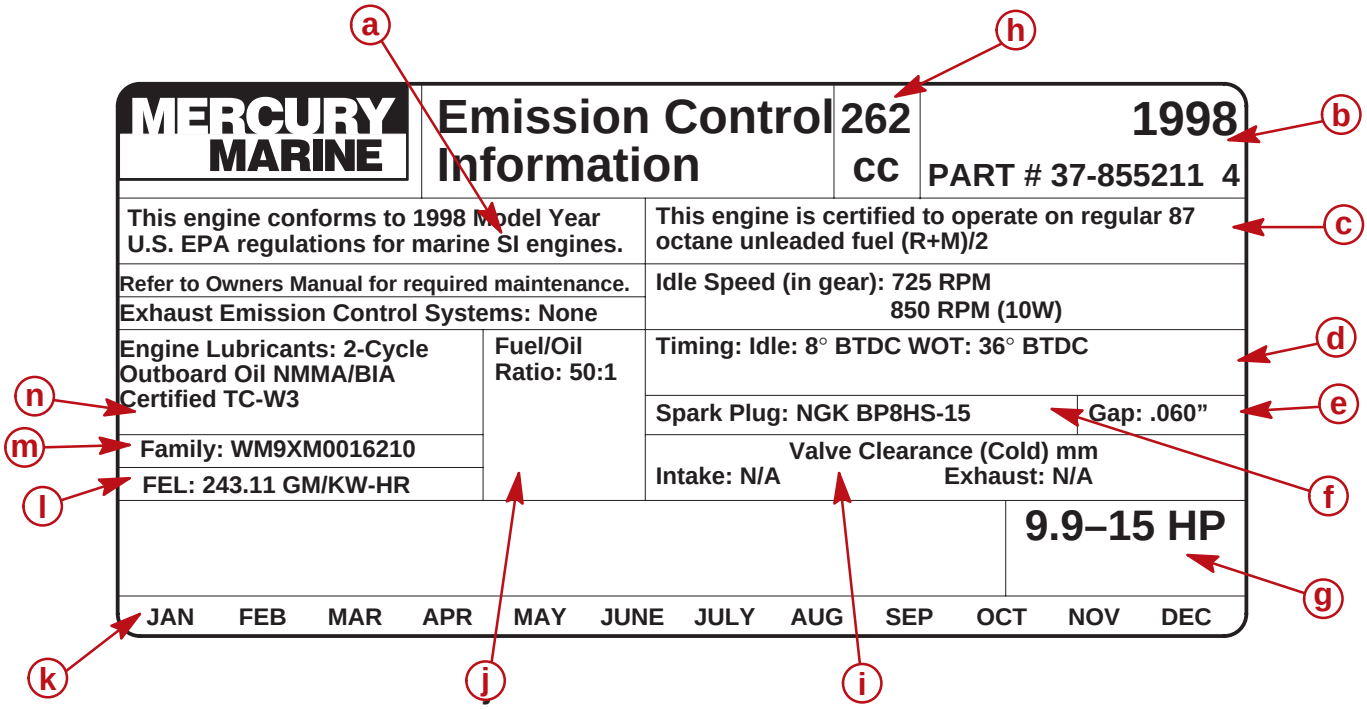
VIA U.S. POSTAL SERVICE:
Office of Mobile Sources
Engine Programs and Compliance Division
Engine Compliance Programs Group (6403J)
401 M St. NW
Washington, DC 20460

VIA EXPRESS or COURIER MAIL:
Office of Mobile Sources
Engine Programs and Compliance Division
Engine Compliance Programs Group (6403J)
501 3rd St. NW
Washington, DC 20001

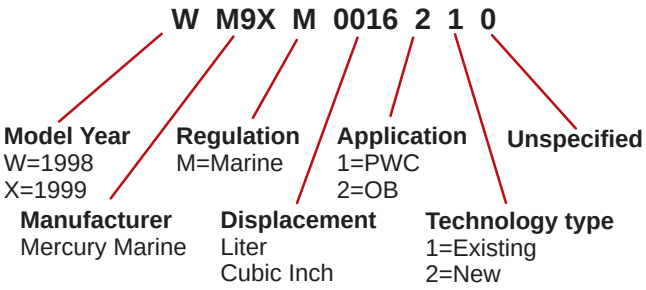
EPA INTERNET WEB SITE:
http:/www.epa.gov/omswww

CERTIFICATION LABEL:

The certification label must be placed on each engine at the time of manufacture and must be replaced in the same location if damaged or removed. Shown below is a typical certification label and is not representative of any one model. Label shown below is not to scale; (shown at twice the normal size).



a - Spark Ignition (SI)
b - Model year of engine and production decal part number
c - Type and octane of fuel used to establish emission levels
d - Timing specifications when adjustable
e - Spark plug gap in thousandths of an inch
f - Recommended spark plug for best engine performance
g - Engine horsepower rating
h - Cubic centimeter
i - Valve clearance (four stroke engines only)
j - Recommended oil/fuel ratio for best engine performance and minimal emissions
k - Month of production (boxing month will be punched)
l - FEL: represents (Mercury Marine) statement of the maximum emissions output for the engine family
m - Family example:



n - Engine lubricants recommended by the manufacturer

Service Replacement Certification Label

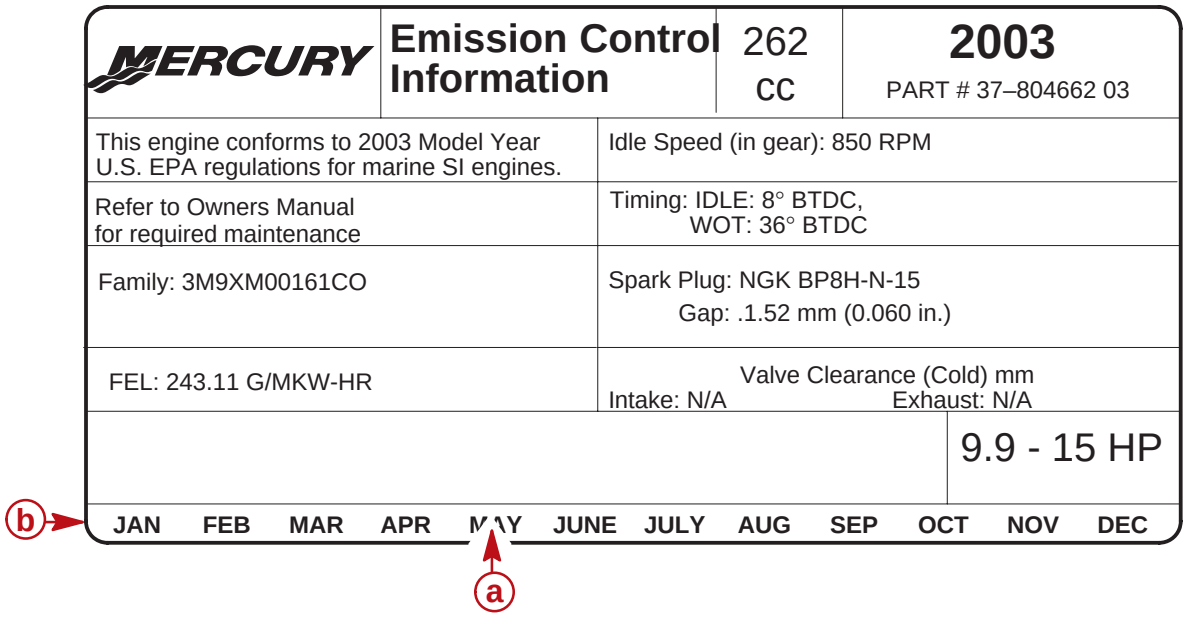
IMPORTANT: By federal law, it is required that all 1998 and newer Mercury Marine outboards have a visible and legible emission certification label. If this label is missing or damaged, contact Mercury Marine Service for replacement if appropriate.

Removal

Remove all remaining pieces of the damaged or illegible label. Do not install new label over the old label. Use a suitable solvent to remove any traces of the old label adhesive from the display location.

Date Code Identification

Cut and remove a “V” notch through the month of engine manufacture before installing the new label. The month of manufacture can be found on the old label. If the label is missing or the date code illegible, contact Mercury Marine Technical Service for assistance.


MERCURY
Emission Control Information
262 CC
2003
PART # 37–804662 03
This engine conforms to 2003 Model Year U.S. EPA regulations for marine SI engines.
Idle Speed (in gear): 850 RPM
Refer to Owners Manual for required maintenance
Timing: IDLE: 8° BTDC, WOT: 36° BTDC
Family: 3M9XM00161CO
Spark Plug: NGK BP8H-N-15
Gap: .1.52 mm (0.060 in.)
FEL: 243.11 G/MKW-HR
Valve Clearance (Cold) mm
Intake: N/A
Exhaust: N/A
9.9 - 15 HP
JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC
b
a

a - “V” notch
b - Month of manufacture

Installation

Install the label on a clean surface in the original factory location.

Decal Location:

Model	Service Part No.	Location on Engine
1998 Merc/Mar 262cc (6-8 hp)	37-855577 3	Inside Rear Top Cowl
1998 Merc/Mar 262cc (9.9-15 hp)	37-855577 4	Inside Rear Top Cowl
1999 Merc/Mar 262cc (6-8 hp)	37-856985 3	Inside Rear Top Cowl
1999 Merc/Mar 262cc (9.9-15 hp)	37-856985 4	Inside Rear Top Cowl
2000 Merc/Mar 262cc (6-8 hp)	37-804659A00	Inside Rear Top Cowl
2000 Merc/Mar 262cc (9.9-15 hp)	37-804662A00	Inside Rear Top Cowl
2001 Merc/Mar 262cc (6-8 hp)	37-804659A01	Inside Rear Top Cowl
2001 Merc/Mar 262cc (9.9-15 hp)	37-804662A01	Inside Rear Top Cowl
2002 Merc/Mar 262cc (6-8 hp)	37-804659A02	Inside Rear Top Cowl
2002 Merc/Mar 262cc (9.9-15 hp)	37-804662A02	Inside Rear Top Cowl
2003 Merc/Mar 262cc (6-8 hp)	37-804659A03	Inside Rear Top Cowl
2003 Merc/Mar 262cc (9.9-15 hp)	37-804662A03	Inside Rear Top Cowl

POWERHEAD

Section 4

Table of Contents

Specifications 4-1
Special Tools 4-3
Powerhead Torque Sequence 4-5
Cylinder Block and Covers 4-6
Crankshaft, Pistons and Flywheel 4-10
Powerhead Removal 4-12
Powerhead Disassembly 4-13
Cylinder Block 4-13
Crankshaft 4-16
Powerhead Cleaning and Inspection 4-20
Cylinder Block and Crankcase Cover . . . 4-20
Exhaust Manifold and Exhaust Cover . . . 4-20
Cylinder Bore 4-20
Crankshaft 4-22
Seals 4-23
Bearings 4-23
Connecting Rod 4-24
Pistons 4-27
Reed Block 4-28
Bleed System 4-30
Thermostat (If Equipped) 4-31
Powerhead Reassembly 4-32
General Information 4-32
Crankshaft 4-32
Cylinder Block 4-39
Powerhead Installation 4-44
Set-Up and Test-Run Procedures 4-45
Break-In Procedure 4-45

4

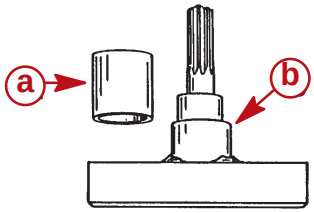
Specifications

Model 6/8/9.9/10/15		
KW (HP)	**Model 6** **Model 8** **Model 8 Sailmate** **Model 9.9** **Model 9.9 Sailpower** **XR/MAG/Viking10** **Model Sea Pro/Marathon 10** **Model 15** **Model Sea Pro/Marathon 15**	4.5 (6) 5.9 (8 5.9 (8) 7.4 (9.9) 7.4 (9.9) 7.5 (10.0) 7.5 (10.0) 11.2 (15) 11.2 (15)
STATIC THRUST	**Model 9.9 Sailpower**	W.O.T. in Forward – 920.7 N (207 Lbs.) W.O.T. in Reverse – 667.2 N (150 Lbs.)
OUTBOARD WEIGHT	**Manual Start** **6** **8** **8 Sailmate** **9.9** **9.9 Sailpower** **XR/MAG/Viking 10** **Sea Pro/Marathon 10** **15** **Sea Pro/Marathon 15** **Electric Start** **6** **8** **9.9** **9.9 Sailpower** **15**	 33.1 kg (73.0 lb) 33.1 kg (73.0 lb) 33.8 kg (74.5 lb) 33.8 kg (74.5 lb) 34.2 kg (76.5 lb) 33.8 kg (74.5 lb) 33.8 kg (74.5 lb) 34.0 kg (75.0 lb) 34.0 kg (75.0 lb) 36.1 kg (79.5 lb) 36.1 kg (79.5 lb) 36.7 kg (81.0 lb) 37.7 kg (83.0 lb) 37.0 kg (81.5 lb)

Model 6/8/9.9/10/15		
CYLINDER BLOCK	**Type**	Two-Stoke Cycle – Cross Flow
	Displacement (1994 Model)	
	6	209cc (12.8 cu. in.)
	8	209cc (12.8 cu. in.)
	9.9	209cc (12.8 cu. in.)
	9.9 Sailpower	209cc (12.8 cu. in.)
	10 Sea Pro/Marathon	262cc (16.0 cu. in.)
	XR/MAG10	262cc (16.0 cu. in.)
	15	262cc (16.0 cu. in.)
	Displacement (1995 and Newer)	
	9.9	262cc (16.0 cu. in.)
	9.9 Sailpower	262cc (16.0 cu. in.)
	10 Sea Pro/Marathon	262cc (16.0 cu. in.
	XR/MAG/Viking 10	262cc (16.0 cu. in.)
	15	262cc (16.0 cu. in.)
	15 Sea Pro/Marathon	262cc (16.0 cu. in.)
STROKE	**Length**	45.7mm (1.800 in.)
CYLINDER BORE	**Diameter (Standard)(1994 Model)**	
	6	53.975mm (2.125 in.)
	8	53.975mm (2.125 in.)
	8 Sailmate	53.975mm (2.125 in.)
	9.9	53.975mm (2.125 in.)
	9.9 Sailpower	53.975mm (2.125 in.)
	10 Sea Pro/Marathon	60.325mm (2.375 in.)
	XR/Mag 10	60.325mm (2.375 in.)
	15	60.325mm (2.375 in.)
	Diameter (Standard)(1995 Model)	
	9.9	60.325mm (2.375 in.)
	9.9 Sailpower	60.325mm (2.375 in.)
	10 Sea Pro/Marathon	60.325mm (2.375 in.)
	XR/Mag/Viking 10	60.325mm (2.375 in.)
	15	60.325mm (2.375 in.)
	15 Sea Pro/Marathon	60.325mm (2.375 in.)
	Taper/Out of Round Maximum	0.1016mm (0.004 in.)
	Bore Type	Cast Iron
CRANKSHAFT	**Top Main Bearing Journal**	19.1mm (0.7517 in.)
	Center Main Bearing Journal	20.6mm (0.8108 in.)
	Bottom Ball Bearing Journal	20.0mm (0.7880 in.)
	Connecting Rod Journal	20.6mm (0.8125 in.)
	Runout	0.076mm (0.003 in.)
CONNECTING ROD	**Piston Pin End (I.D.)**	20.8mm (0.8195 in.)
	Crankpin End (I.D.)	27.0mm (1.0635 in.)
PISTON	**Piston Type**	Aluminum
	Ring End Gap	0.25 mm - 0.46 mm (0.010 in. - 0.018 in.)
REEDS	**Reed Stand Open (Maximum)**	
	All Models	0.178mm (0.007 in.)
	Reed Stop Opening (Maximum)	
	All Models	7.54mm (0.296 in.)

Special Tools

1. Powerhead Stand 91-13662T1

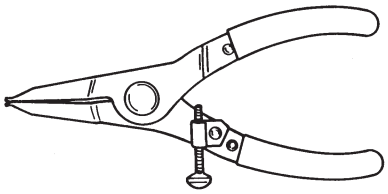


a - Bushing 23-13653
b - Stand 91-13662

2. Piston Pin Tool 91-13663T1



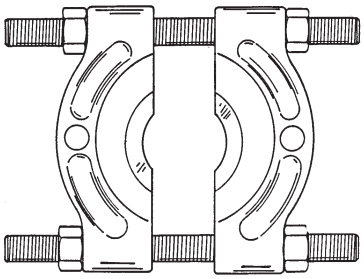
3. Snap Ring Pliers 91-24283 * **NLA**



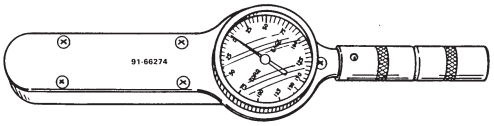
4. Torque Wrench (0-200 lb. ft.) 91-32610* **NLA**



5. Universal Puller Plate 91-37241

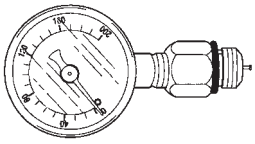


6. Torque Wrench (0-150 lb. in.) (91-66274)*

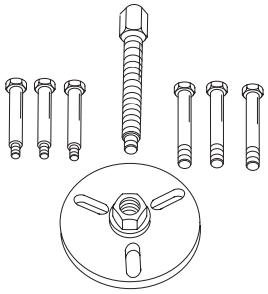


*May be obtained locally.

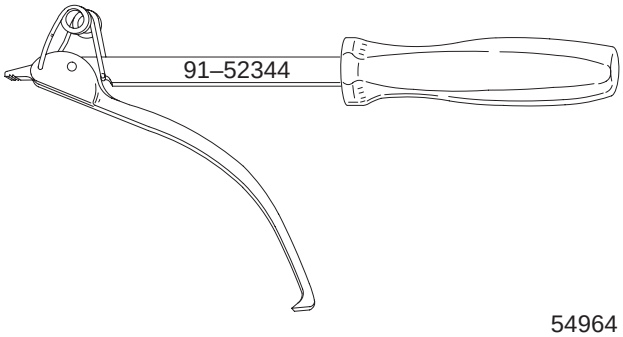
7. Compression Tester 91-29287



8. Flywheel Puller 91-83164M

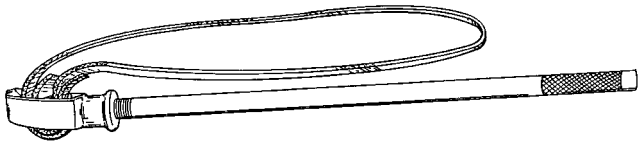


9. Flywheel Holder 91-52344

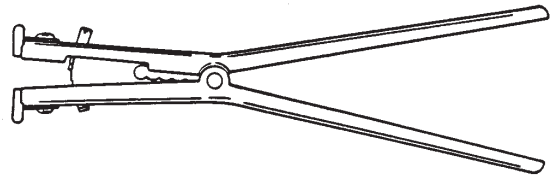


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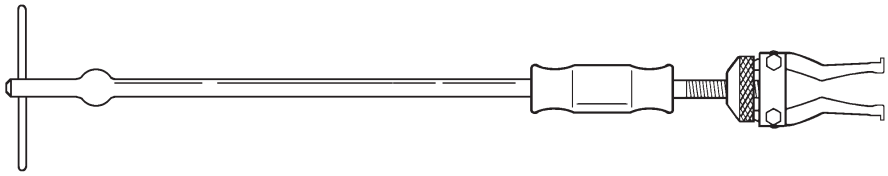
10. Strap Wrench 91-24937A1



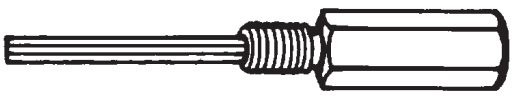
11. Ring Expander 91-24697



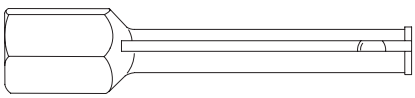
12. Slide Hammer 91-34569A1



13. Expanding Rod **CG40-4** (Snap-On)

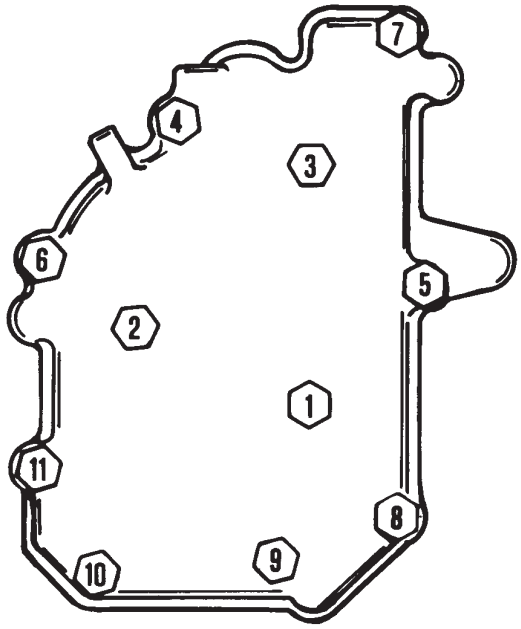


14. Collet **CG40-15** (Snap-On)



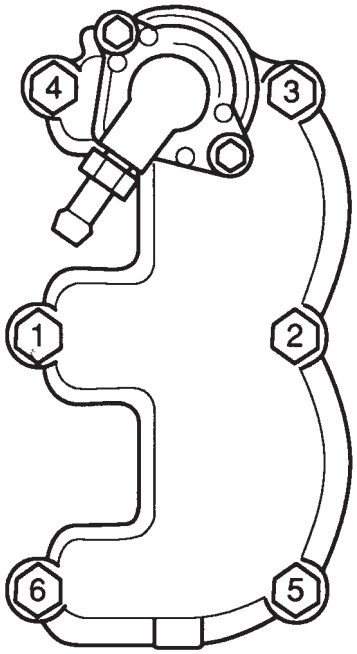
Powerhead Torque Sequence

EXHAUST COVER TORQUE SEQUENCE



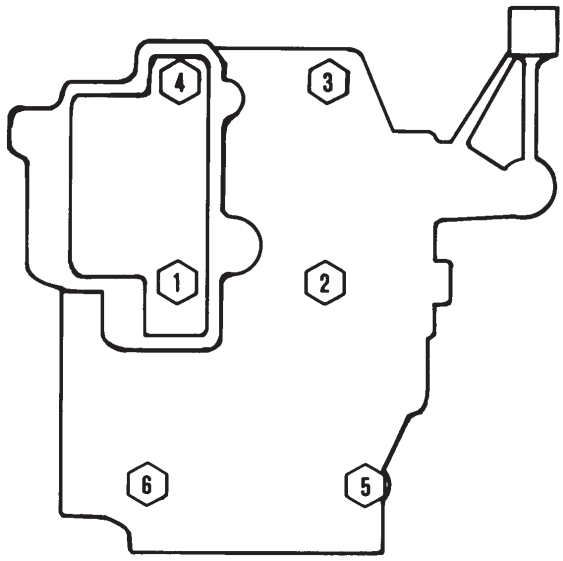
6.8 Nm (60 lb. in.)

CYLINDER BLOCK COVER TORQUE SEQUENCE

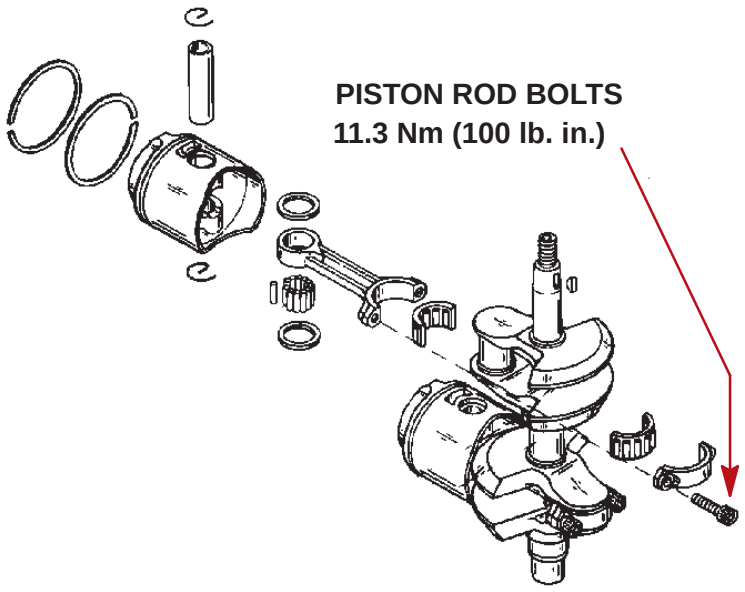


6.8 Nm (60 lb. in.)

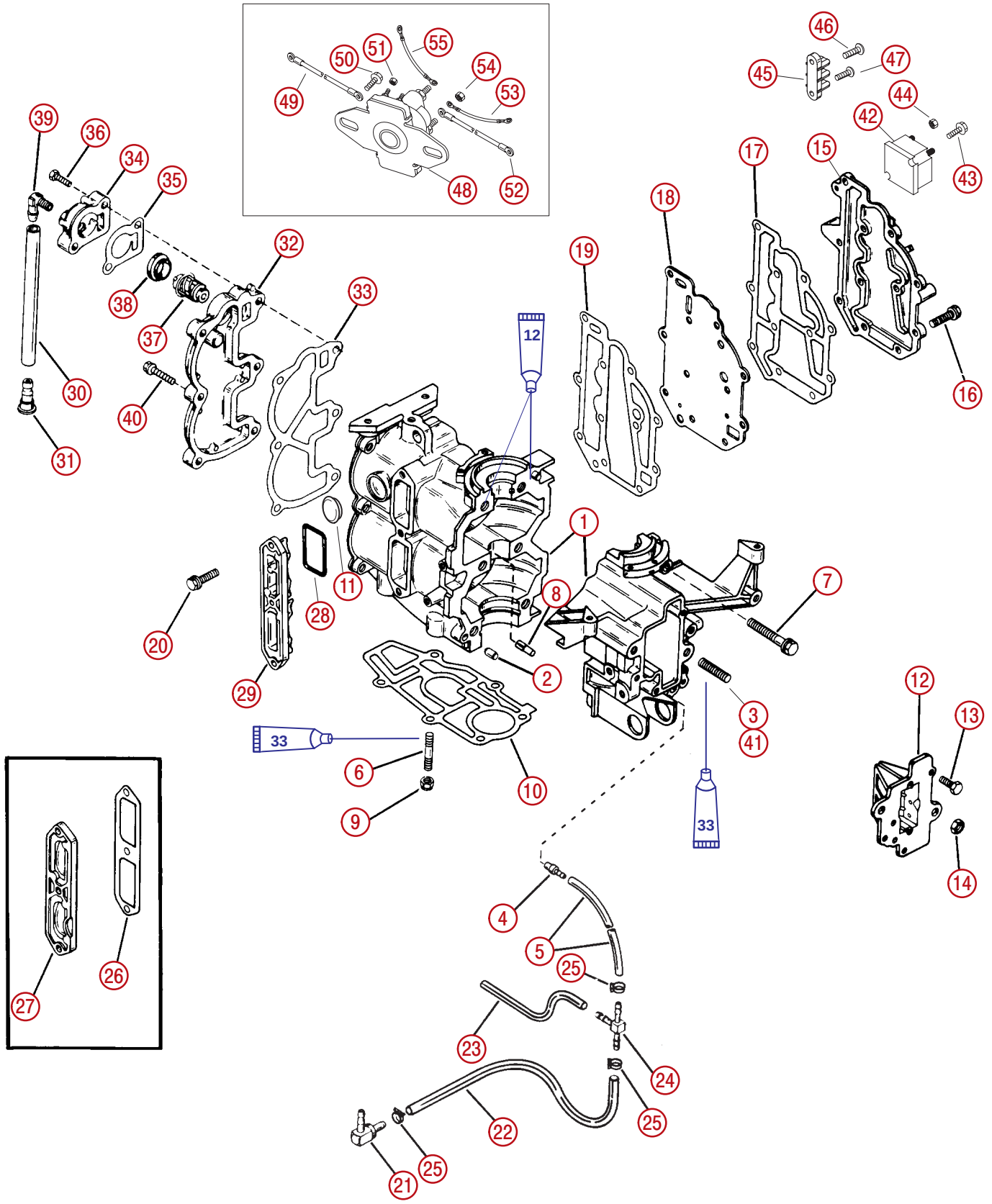
CRANKCASE COVER TORQUE SEQUENCE



22.6 Nm (16.7 lb. ft.)



Cylinder Block and Covers



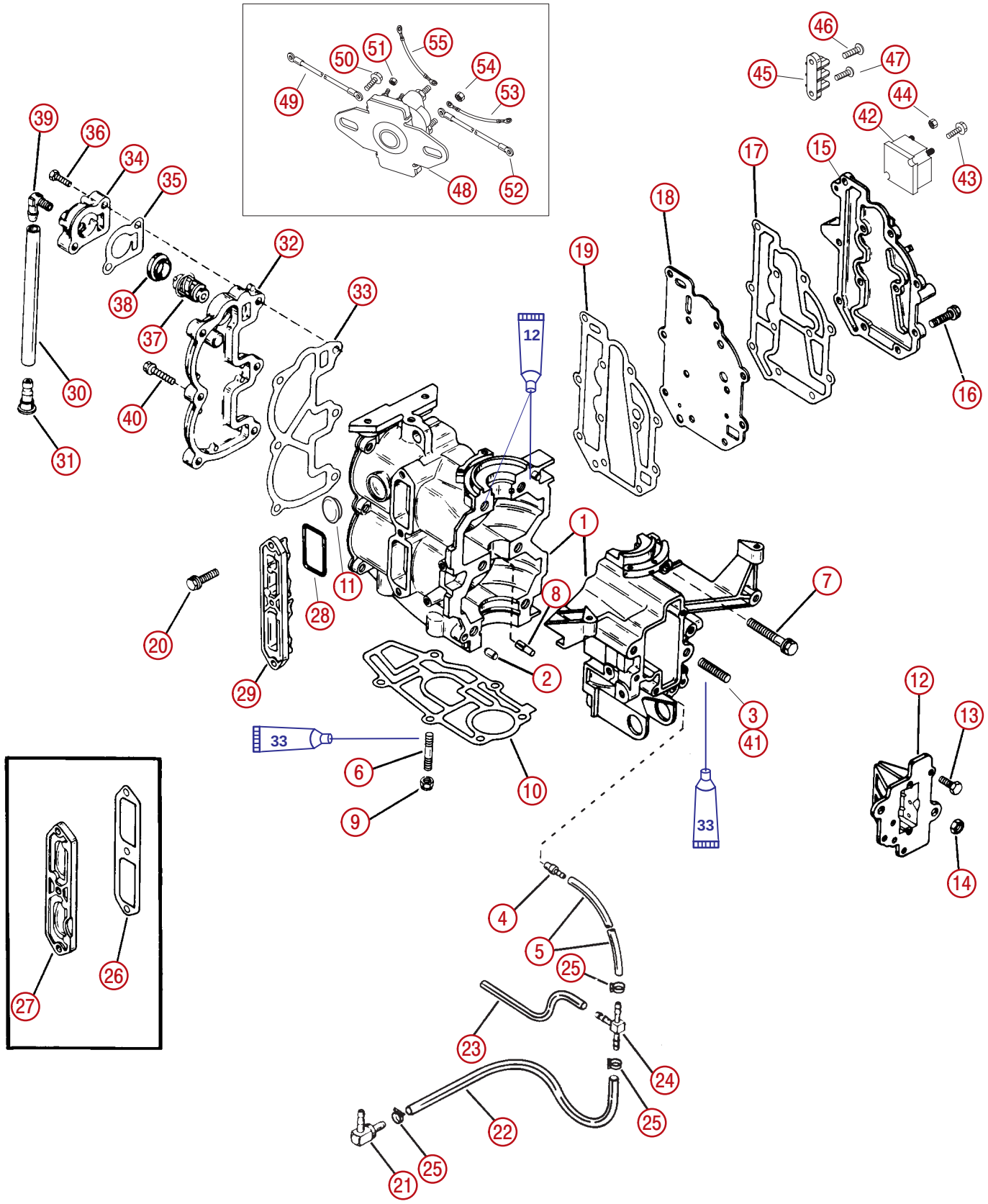
12 Loctite Master Gasket

33 Loctite 680 Retaining Compound

Cylinder Block and Covers (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CYLINDER BLOCK **(6)**			
	1	CYLINDER BLOCK **(8)**			
	1	CYLINDER BLOCK **(9.9/15)**			
2	2	DOWEL PIN–cylinder block			
3	2	STUD–carburetor			
4	1	CHECK VALVE–bleed hose			
5	1	HOSE–bleed (2-1/2 IN.)			
6	2	STUD–cylinder block			
7	6	SCREW–crankcase to cylinder block		16.5	22.6
8	1	GROOVE PIN **(9.9/15)**			
9	2	NUT–cylinder block stud	100		11.3
10	1	GASKET–powerhead			
11	1	PLUG-Serial Number			
12	1	REED BLOCK			
13	3	SCREW–reed block			
14	2	NUT–carburetor stud	125		14.1
15	1	COVER–exhaust			
16	11	SCREW–exhaust cover to cylinder block	60		6.8
17	1	GASKET–exhaust cover			
18	1	BAFFLE PLATE			
19	1	GASKET–baffle plate			
20	3	SCREW–cover to cylinder block	60		6.8
21	1	FITTING			
22	1	TUBING (7 IN.)			
23	1	TUBING (5-1/4 IN.)			
24	1	TEE			
25	AR	CABLE-TIE			

Cylinder Block and Covers (continued)



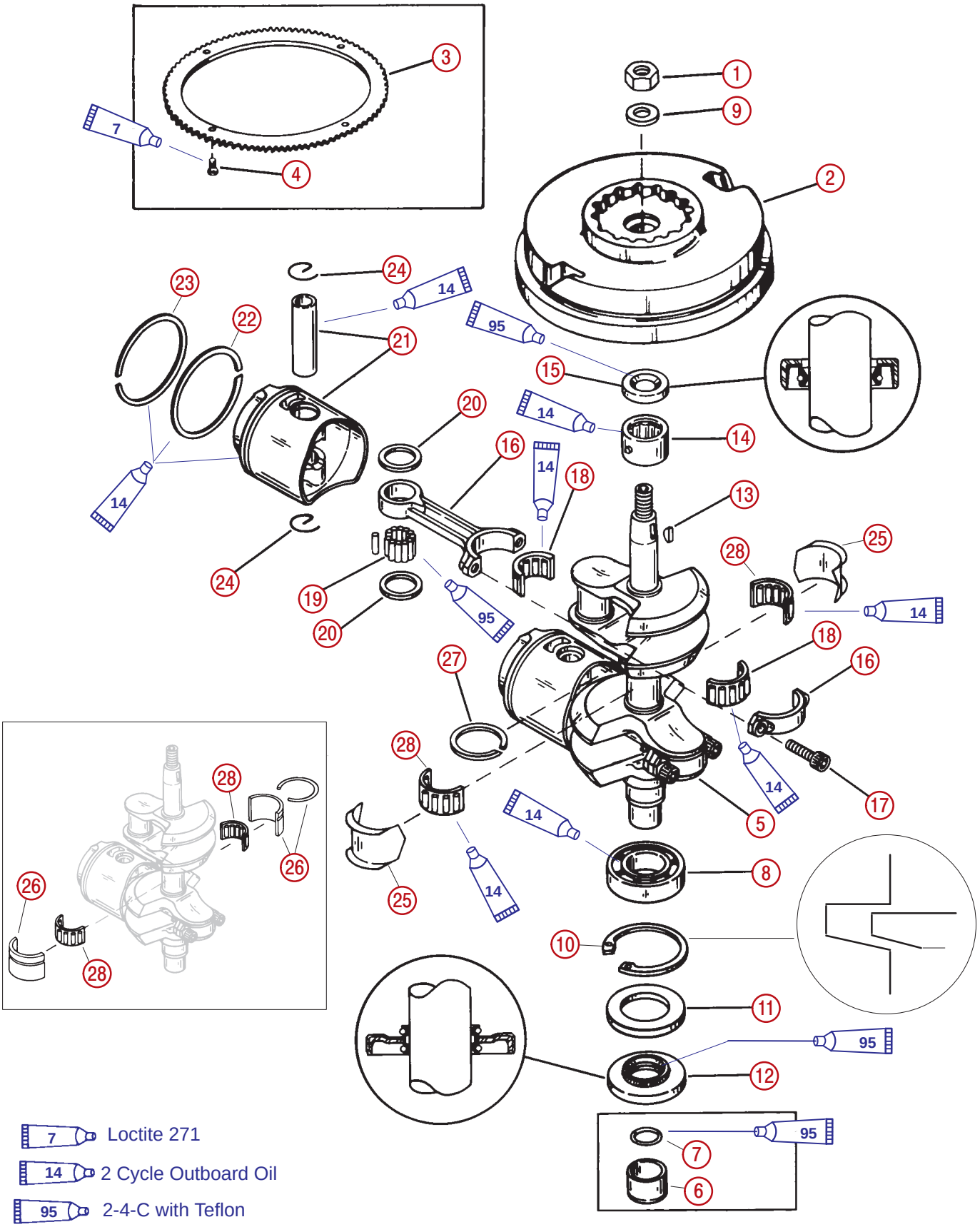
12 Loctite Master Gasket

33 Loctite 680 Retaing Compound

Cylinder Block and Covers (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
26	1	GASKET **6/8**			
27	1	INTAKE COVER			
28	2	O-RING **9.9/15**			
29	1	INTAKE COVER			
30	1	HOSE–tell tale (6 IN.)			
31	1	FITTING–tell tale hose - bottom cowl			
32	1	COVER ASSEMBLY			
33	1	GASKET			
34	1	COVER–thermostat			
35	1	GASKET			
36	2	SCREW	60		6.8
37	1	THERMOSTAT (120 degrees) **9.9/15**			
38	1	GASKET–thermostat			
39	1	FITTING			
40	6	SCREW–cover attaching	60		6.8
41	2	STUD-carb **(RESTRICTED/NORWAY MODELS)**			
42	1	RECTIFIER			
43	2	SCREW (5/8) **ELECTRIC**	Drive Tight		
44	3	NUT	25		2.8
45	1	TERMINAL BLOCK			
46	2	SCREW (5/8 IN.) **ALTERNATOR MODELS**	Drive Tight		
47	2	SCREW (3/8 IN.)	Drive Tight		
48	1	STARTER SOLENOID			
49	1	BATTERY CABLE **(NEGATIVE)**			
50	2	SCREW (M6 x 14) **ELECTRIC**	70		7.9
51	2	NUT (10-32)	15		1.7
52	1	BATTERY CABLE **(POSITIVE)**			
53	1	WIRE (YELLOW)			
54	2	NUT (1/4-20)	30		3.4
55	1	WIRE (RED)**(15 ELECTRIC HANDLE)**			

Crankshaft, Pistons and Flywheel



Crankshaft, Pistons and Flywheel (continued)

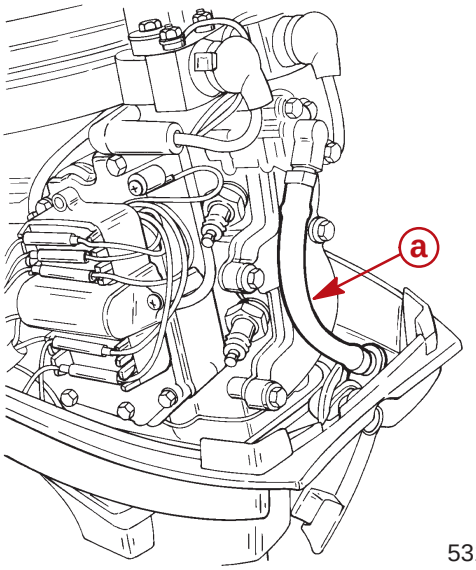
REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	NUT		50	67.8
2	1	FLYWHEEL ASSEMBLY			
3	1	RING GEAR–flywheel **ELECTRIC**			
4	4	SCREW (M5 x 13)	65		7.3
5	1	CRANKSHAFT ASSEMBLY			
6	1	SLEEVE			
7	1	O-RING			
8	1	BALL BEARING - lower			
9	1	WASHER			
10	1	RETAINING RING			
11	1	WASHER - lower			
12	1	OIL SEAL - lower			
13	1	KEY			
14	1	ROLLER BEARING			
15	1	OIL SEAL - upper			
16	2	CONNECTING ROD ASSEMBLY			
17	4	SCREW	100		11.3
18	3	ROLLER BEARING			
19	48	NEEDLE BEARING - piston end			
20	4	THRUST BEARING			
21	2	PISTON AND PIN ASSEMBLY **(6/8)**			
	2	PISTON AND PIN ASSEMBLY **(9.9/15)**			
22	1	PISTON RING ASSEMBLY **(6/8)**			
	1	PISTON RING ASSEMBLY **(9.9/15)**			
23	2	PISTON RING - top **(6/8)**			
	2	PISTON RING - top **(9.9/15)**			
24	4	LOCK RING			
25	1	LINER – center main bearing **(6/8)**			
26	1	BEARING **(9.9/15)**			
27	1	SEAL – main bearing			
28	1	ROLLER BEARING**(9.9/15)**			

Powerhead Removal

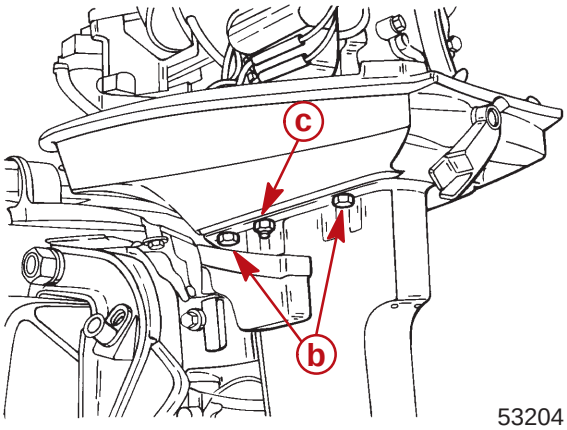
1. Remove the following components/assemblies referring to the listed service manual sections:

Component/Assembly	Section
Rewind Starter	8
Flywheel and Ignition/Electrical Components	2A/B
Throttle/Shift Mechanism	7A/B/C
Carburetor	3

2. Disconnect tell-tale hose from bottom cowl.
3. Remove 4 bolts and 2 nuts.



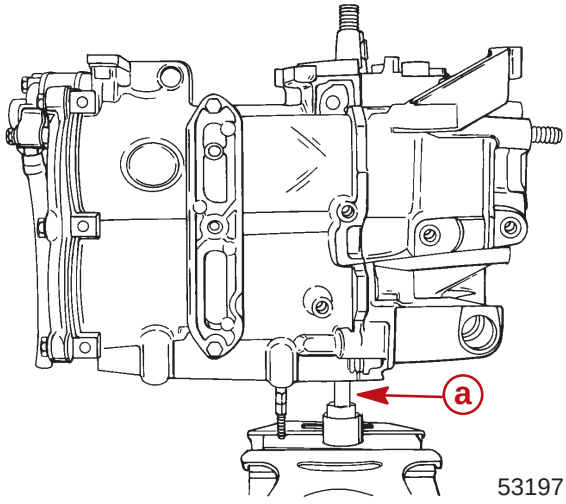
53125



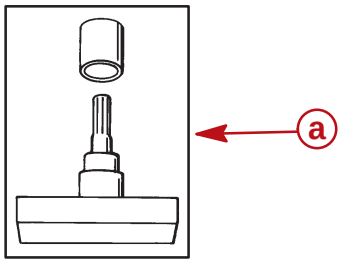
53204

a - Tell-tale hose
b - Bolts (2 each side)
c - Nut (1 each side)

4. Push powerhead sideways to break gasket and lift powerhead from drive shaft housing.
5. Place powerhead on bench or powerhead stand mounted in vise.



53197



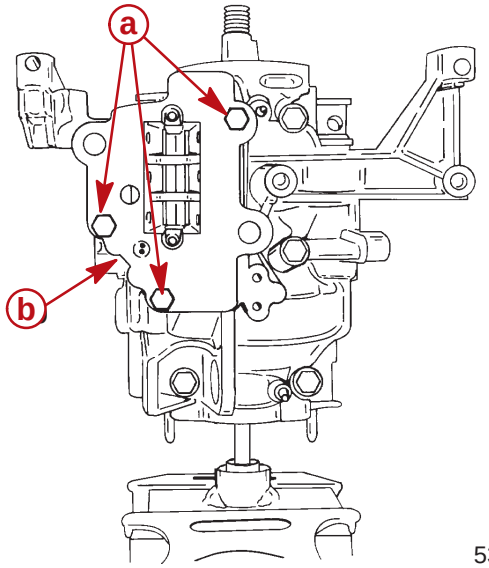
53203

a - Powerhead Stand (91-13662T1)

Powerhead Disassembly

Cylinder Block

1. Remove 3 bolts and remove intake manifold/reed block.



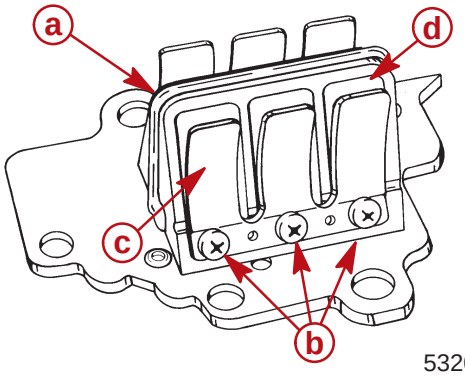
53191

a - Bolts
b - Intake manifold/reed block

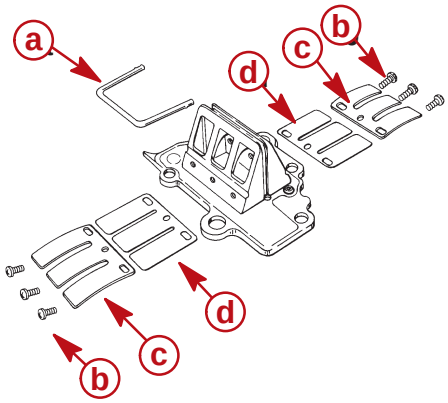
IMPORTANT: Reed block can be inspected without disassembling. Refer to Cleaning and Inspection, following. If inspection of reed block indicates that replacement of a part is necessary, disassemble reed block as outlined.

2. If necessary, disassemble reed block as follows:
   a. Pull ends of rubber seal from holes in intake manifold/reed block.
   b. Remove 6 screws and separate reed stops and reeds.

1994 – 1996 Reed Blocks



53202

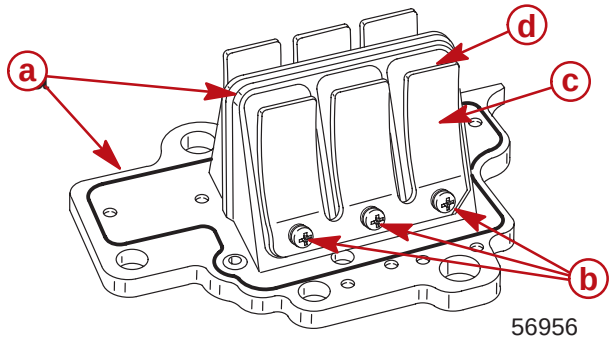


53196

a - Rubber seal
b - Screws
c - Reed stop
d - Reeds

1997 and Newer Reed Blocks (Rubber Coated)

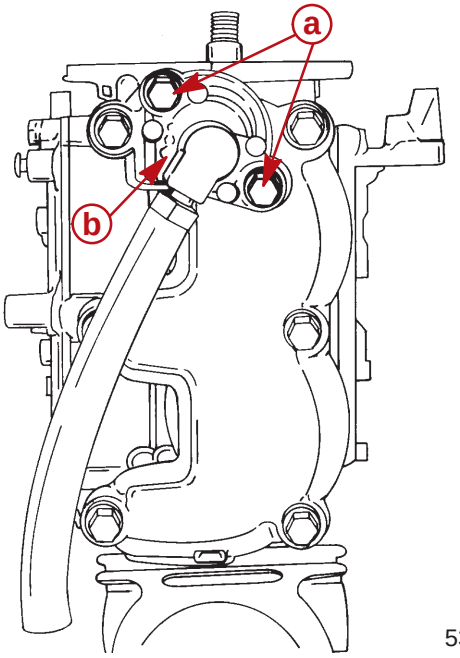
NOTE: *Individual components of 1997 and newer reed block assemblies are not sold separately. If individual components are found to be not serviceable, entire reed block assembly must be replaced.*



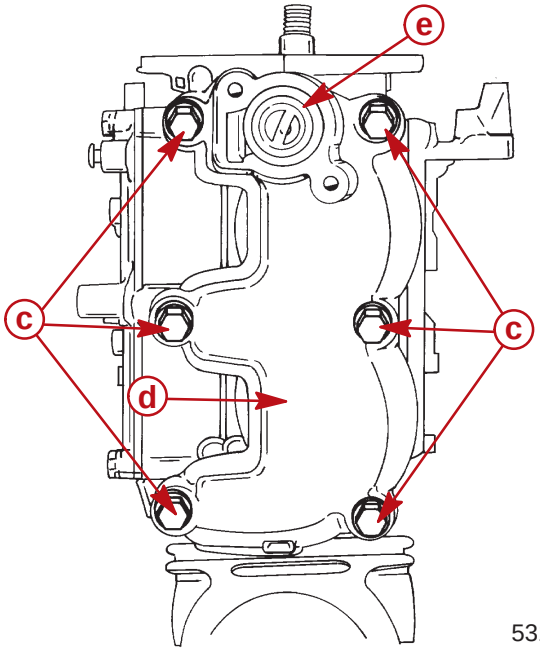
56956

a - Rubber seal
b - Screws
c - Reed stop
d - Reeds

3. Remove 2 bolts and remove thermostat cover.
4. Remove thermostat (if equipped).
5. Remove 6 bolts and remove cylinder block cover.



53194



53193

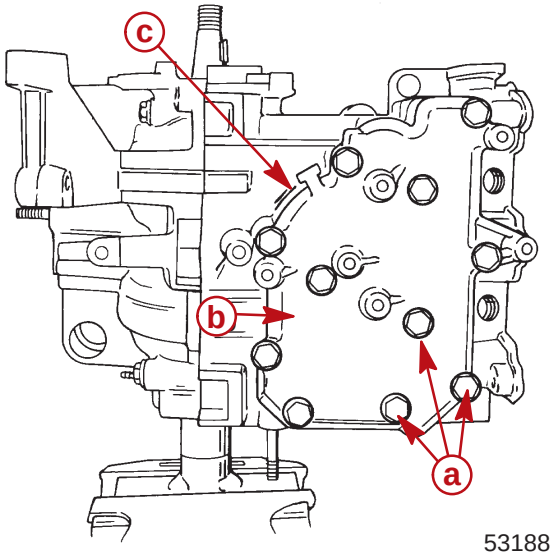
a - Bolts (2)
b - Cover
c - Bolts
d - Cover
e - Thermostat (if equipped)

6. Remove 10 bolts and separate exhaust cover and exhaust manifold from cylinder block.

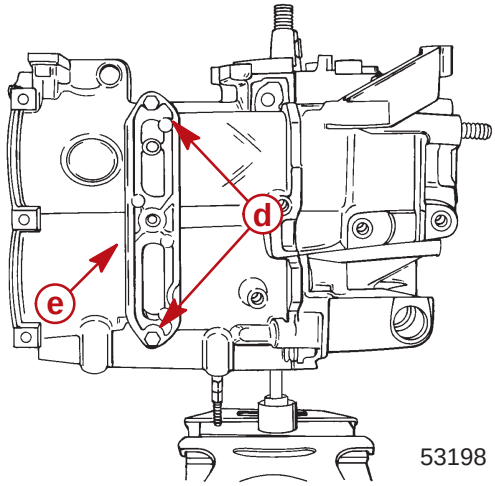
NOTE: *If engine is suspected of having been overheated or spark plugs are grayish colored (a sign of possible water intrusion), inspect exhaust manifold for warpage or for proper placement and integrity of gaskets which mayl allow water to enter cylinders through exhaust ports.*

7. Remove 2 bolts and intake cover.

NOTE: *1995-newer Model 9.9/15 powerheads have O-rings under intake cover instead of a gasket. This style intake cover with O-rings WILL NOT backfit prior models.*



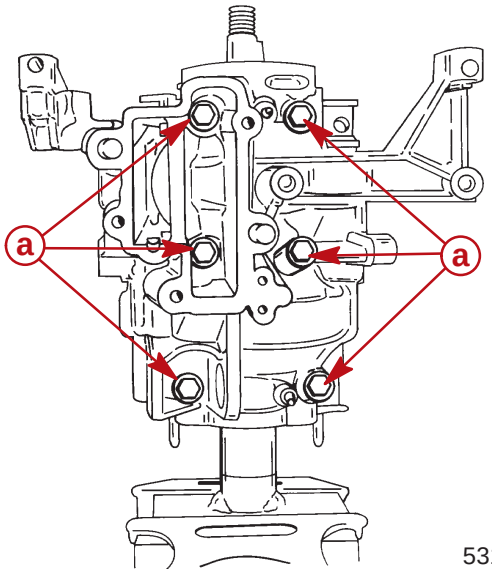
53188



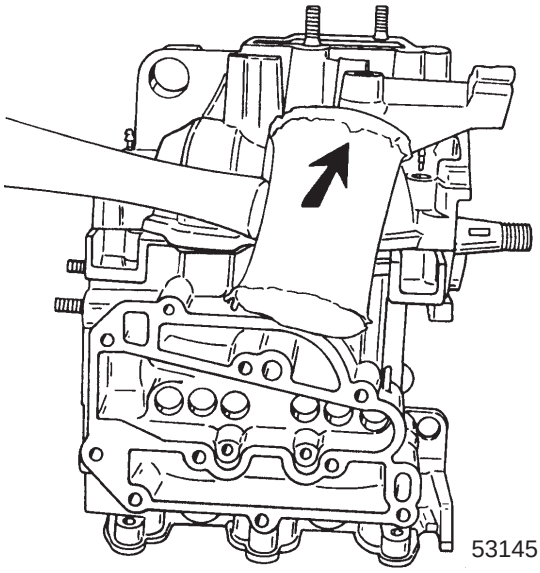
53198

a - Bolts (10)
b - Exhaust cover
c - Exhaust manifold
d - Bolts (2)
e - Intake cover

8. Remove 6 bolts which secure crankcase cover to cylinder block.
9. Use soft mallet to break seal between crankcase cover and cylinder block.



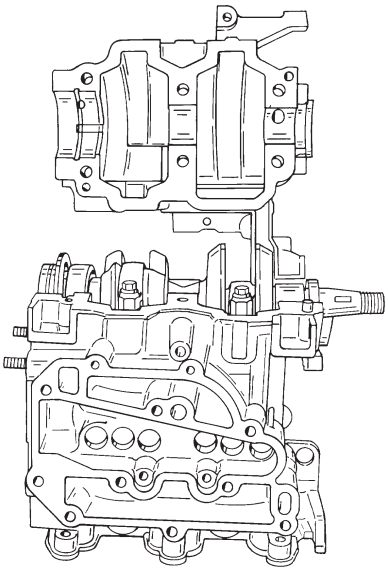
53192



53145

a - Bolts (6)

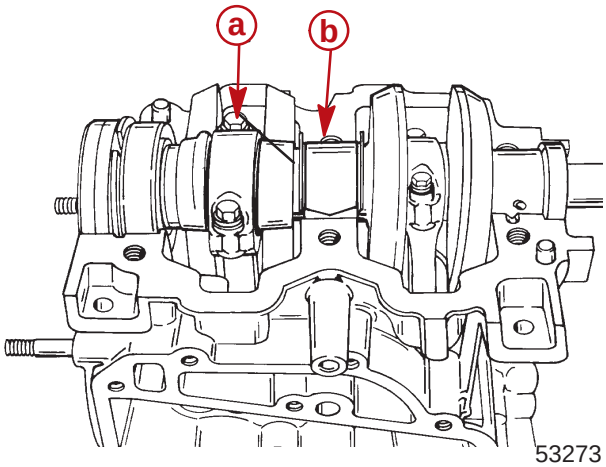
10. Lift crankcase cover from block.



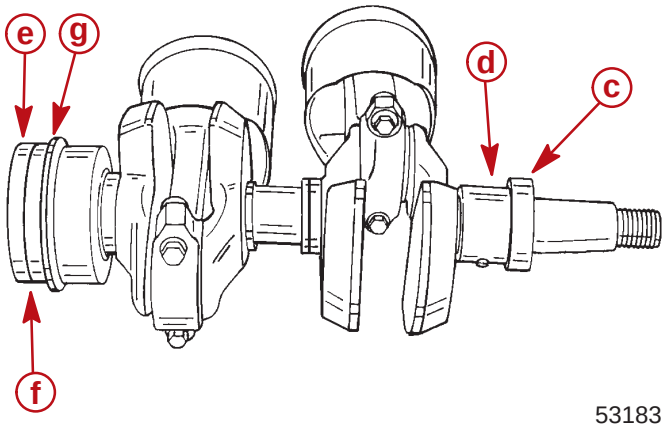
53124

Crankshaft

1. Lift crankshaft assembly from cylinder block.
2. **All Models Except 15 and 1995 9.9/10:** Remove center main bearing halves and sleeve halves from crankshaft and/or cylinder block.
3. Remove upper crankshaft seal and bearing.
4. Remove lower crank shaft seal, stuffer washer and retaining ring.



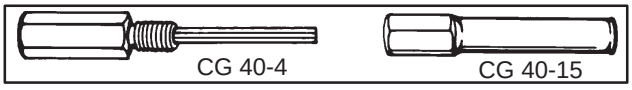
53273



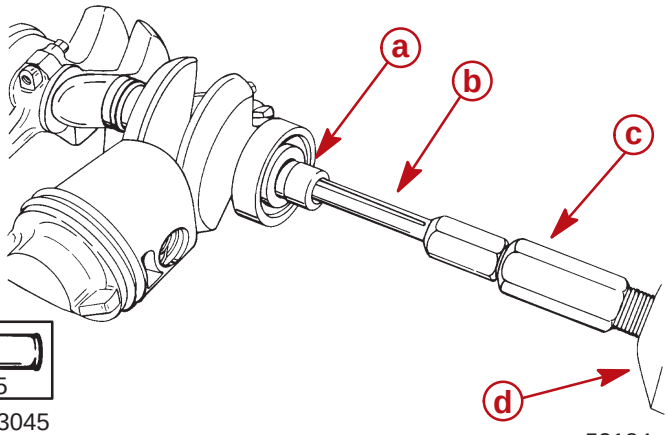
53183

a - Bearing halves (hidden)
b - Sleeve halves
c - Crankshaft seal (upper)
d - Bearing
e - Crankshaft seal (lower)
f - Stuffer washer
g - Retainer

5. Remove (and discard) coupling seal using:
   Snap On* Expanding Rod (CG 40-4)
   Snap On* Collet (CG 40-15)
   Slide Hammer (91-34569A1)
   *Purchase from: Snap On Tools Corporation
   2801 - 80th Street
   Kenosha, WI 53141-1410



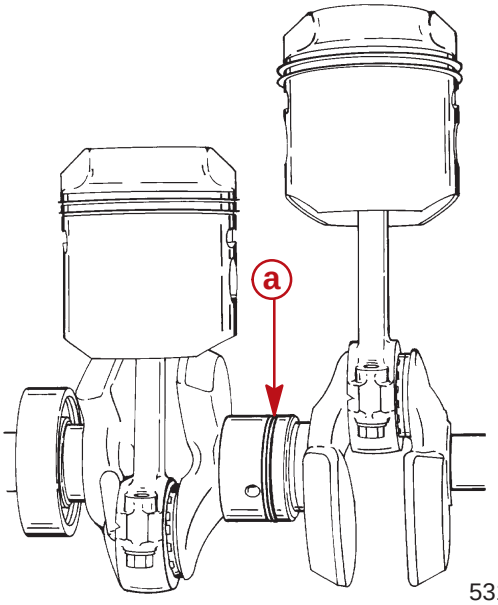
53045



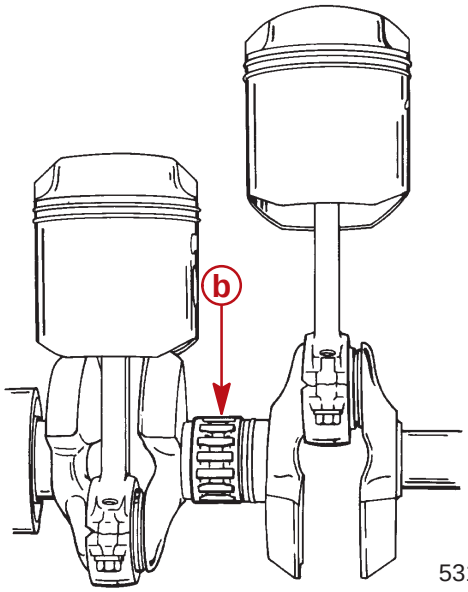
53184

a - Coupling seal
b - Collet (CG 40-15)
c - Expanding Rod (CG 40-4)
d - Slide Hammer (91-34569A1)

6. **Model 15 and 1995 9.9/10 Center Main Bearing Removal:**
   a. Remove retaining ring from groove of center main bearing race.
   b. Remove center main bearing races and center main bearing halves.



53128



53133

a - Retaining ring
b - Bearing halves

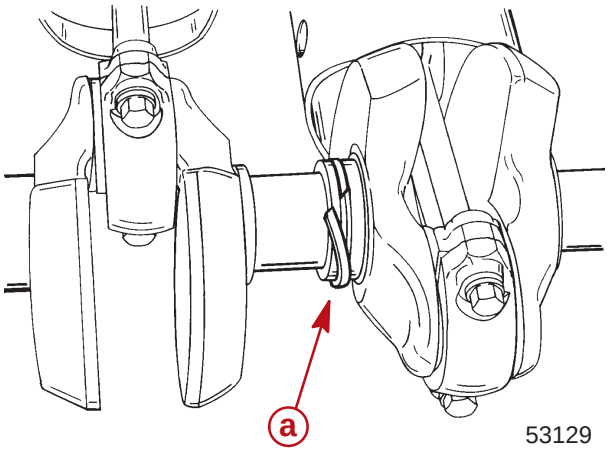
7. Remove sealing ring.

⚠ CAUTION

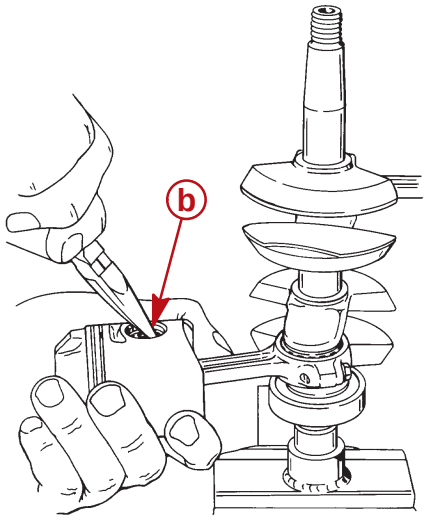
Eye protection MUST BE worn while removing piston pin lockrings.

IMPORTANT: Identify upper (#1) and lower (#2) pistons and connecting rods. Store piston pin, piston pin needle bearings, locating washers, connecting rod bearings, rod caps and bolts together with corresponding piston and connecting rod for reassembly.

8. Remove (and discard) piston pin lockrings.



53129

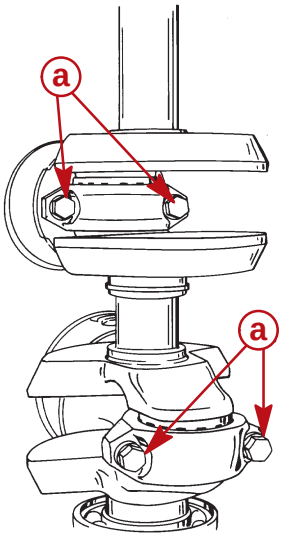


53139

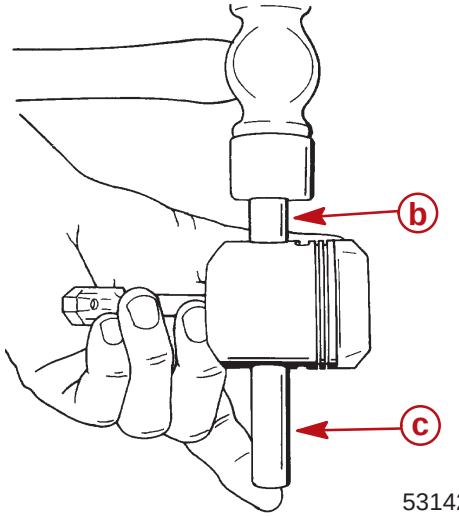
a - Sealing ring
b - Lockrings

IMPORTANT: It is recommended that the piston and rod assembly be removed from the crankshaft before removing the piston pin to prevent possible bending of the connecting rod.

9. Remove rod bolts and remove piston and rod assembly from crankshaft.
10. While supporting piston, use Piston Pin Tool and soft faced mallet to drive piston pin from piston.



52137

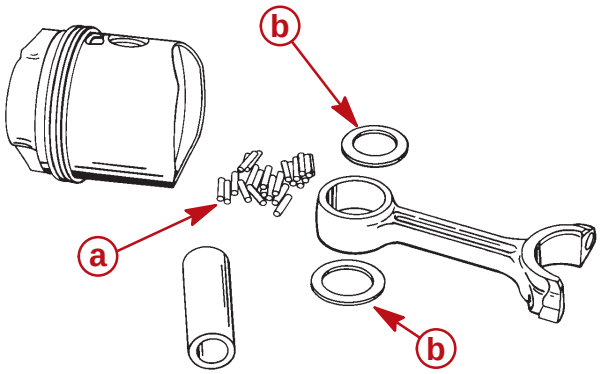


53142

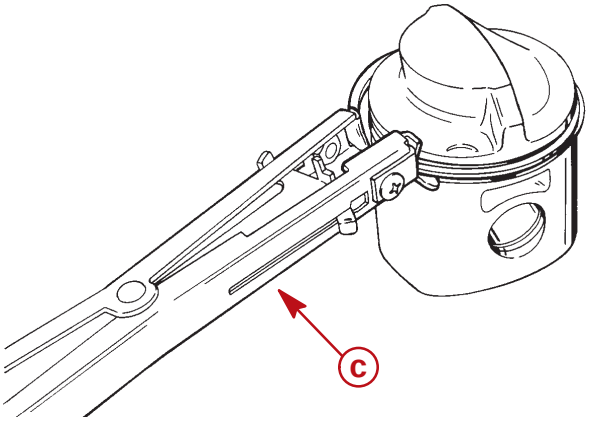
a - Rod bolts
b - Piston Pin Tool (91-13663T 1)
c - Piston pin

IMPORTANT: Piston pin needle bearings and locating washers will fall out when piston is removed from connecting rod.

11. Slide piston pin tool from piston and remove piston, needle bearings and locating washers.
12. Using Piston Ring Expander, remove (and discard) piston rings.



53264

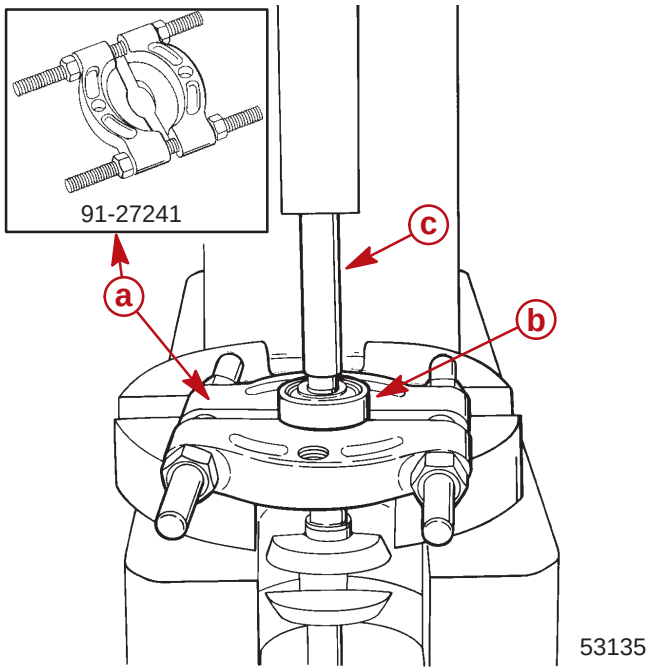


53271

a - Needle bearings
b - Locating washers
c - Ring Expander (91-24697)

IMPORTANT: DO NOT remove ball bearing from crank shaft unless replacement is necessary as removal process will damage bearing. Refer to Cleaning and Inspection following.

13. Remove lower crankshaft ball bearing using Universal Puller Plate, suitable mandrel (to protect crank shaft while pressing) and press.



53135

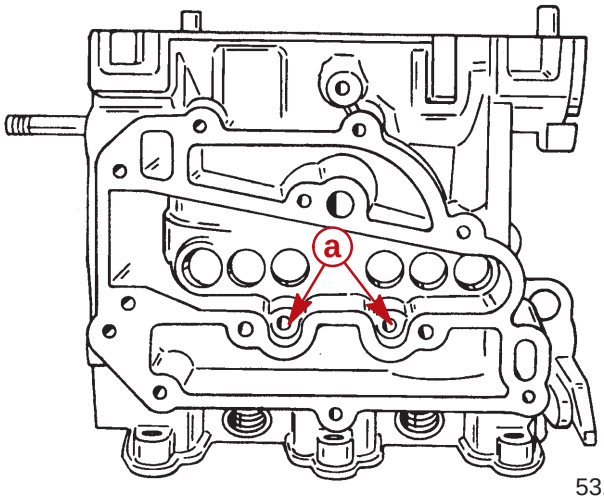
a - Universal Puller Plate (91-27241)
b - Ball bearing
c - Mandrel

Powerhead Cleaning and Inspection

Cylinder Block and Crankcase Cover

IMPORTANT: Crankcase cover and cylinder block are a matched, line-bored assembly and must be replaced as a set.

1. Thoroughly clean cylinder block and crankcase cover. Verify that all sealant and old gaskets are removed from mating surfaces. Remove all carbon deposits from exhaust ports, decompression ports and cylinder dome.
2. Inspect cylinder block and crankcase cover for cracks or fractures.
3. Check gasket surfaces for nicks, deep grooves, cracks and distortion.
4. Inspect all water and fuel passages in cylinder block and crankcase cover for obstructions.
5. Verify that all fittings and plugs are tight.



53148

a - Decompression ports

Exhaust Manifold and Exhaust Cover

1. Remove all carbon deposits and gasket material from exhaust manifold and cover.
2. Inspect for grooves, cracks or distortion that could cause leakage. Replace parts as required.

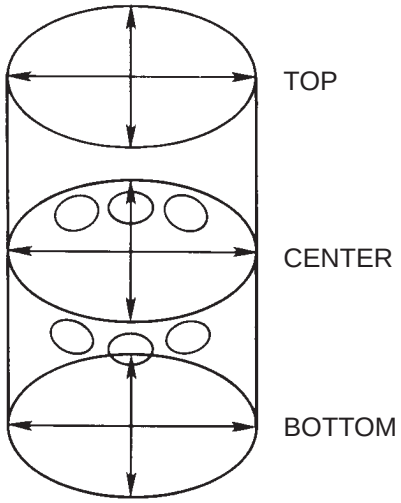
Cylinder Bore

NOTE: *Cylinder sleeve is part of the cylinder block and cannot be replaced.*

MEASURING CYLINDER BORE

1. Inspect cylinder bores for scoring, scuffing or a transfer of aluminum from piston to cylinder wall. Scoring or scuffing, if NOT TOO SEVERE, can normally be removed by honing. If a transfer of aluminum has occurred, an acidic solution such as TIDY BOWL CLEANER should be applied to the areas of the cylinder bore where transfer of aluminum has occurred. After the acidic solution has removed the transferred aluminum, thoroughly flush the cylinder bores to remove any remaining acid. Cylinder walls may now be honed to remove any glaze and to aid in the seating of new piston rings.
2. Measure ring traveled area of cylinder bore at 3 depths, (6 places) by positioning measuring instrument in-line with and at right angle (90°) to piston pin centerline.

3. If cylinder bore is tapered, egg shaped or out-of-round by more than 0.1mm (0.004 in.), replace cylinder block.



STANDARD CYLINDER BORE DIAMETER

1994 MODEL	**6/8/9.9**	**53.98MM (2.125 IN.)**
	10/15	**60.3MM (2.375 IN.)**
1995 - NEWER MODEL	**6/8**	**53.98MM (2.125 IN.)**
	9.9/10/15	**60.3MM (2.375 IN.)**

HONING PROCEDURE

a. When cylinders are to be honed, follow the hone manufacturer's recommendations for use of the hone and cleaning and lubrication during honing.

b. For best results, a continuous flow of honing oil should be pumped into the work area. If pumping oil is not practical, use an oil can. Apply oil generously and frequently on both stones and work area.

⚠ CAUTION

When honing cylinder block, remove hone frequently and check condition of cylinder walls. DO NOT hone any more than absolutely necessary, as hone can remove cylinder wall material rapidly.

c. Start stroking at smallest diameter. Maintain firm stone pressure against cylinder wall to assure fast stock removal and accurate results.

d. Localize stroking in the smallest diameter until drill speed is constant throughout length of bore. Expand stones, as necessary, to compensate for stock removal and stone wear. Stroke at a rate of 30 complete cycles per minute to produce best cross-hatch pattern. Use honing oil generously.

e. Thoroughly clean cylinder bores with hot water and detergent. Scrub well with a stiff bristle brush and rinse thoroughly with hot water. A good cleaning is essential. If any of the abrasive material is allowed to remain in the cylinder bore, it will cause rapid wear of new piston rings and cylinder bore in addition to bearings. After cleaning, bores should be swabbed several times with engine oil and a clean cloth, then wiped with a clean, dry cloth. Cylinders **should not** be cleaned with kerosene or gasoline. Clean remainder of cylinder block to remove excess material spread during honing operation.

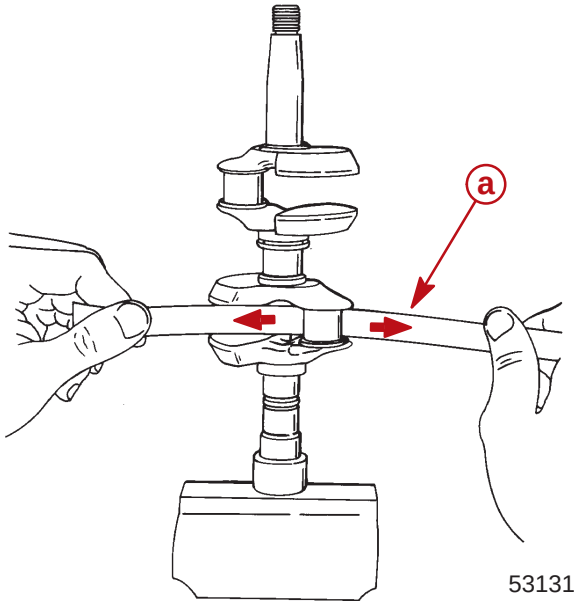
4. Hone all cylinder walls **just enough** to de-glaze walls.

5. Measure cylinder bore diameter (with a snap gauge micrometer) at top, middle and bottom of each cylinder. Check for tapered, out-of-round (egg-shaped) and oversize bore.

IMPORTANT: Ports must be deburred after honing.

Crankshaft

1. Inspect crankshaft to drive shaft splines for wear.
2. Check crankshaft for straightness [runout – 0.076mm (0.003 in.)].
3. Inspect crankshaft oil seal surfaces. Sealing surfaces must not be grooved, pitted or scratched. If top crankshaft sealing surface is severely worn, replace crankshaft. If bottom crankshaft sealing surface is worn, replace crankshaft coupling seal.
4. Check all crankshaft bearing surfaces for rust, water marks, chatter marks, uneven wear and/or overheating (blued).
5. If necessary, clean up crankshaft bearing surfaces with crocus cloth.

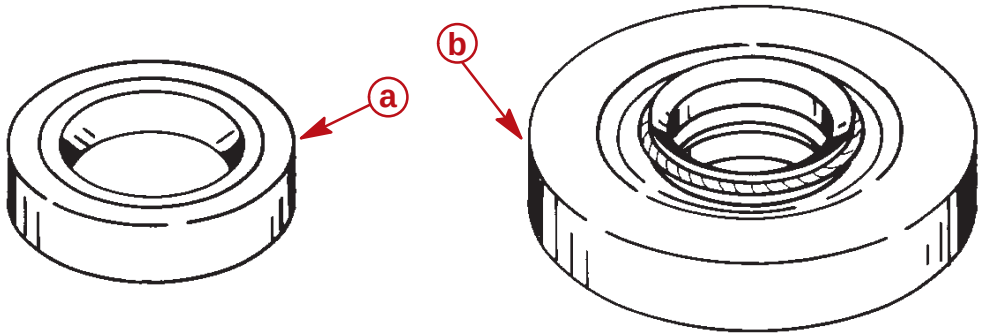


a - Crocus Cloth

6. Thoroughly clean crankshaft with solvent and dry with compressed air.
7. Recheck surfaces of crankshaft and replace crankshaft if surfaces can not be properly cleaned up.
8. If crankshaft will be reused, apply light oil to prevent rust.

Seals

It is recommended that all seals be replaced as a standard rebuilding procedure.



53200

a - Top crankshaft seal
b - Bottom crankshaft seal

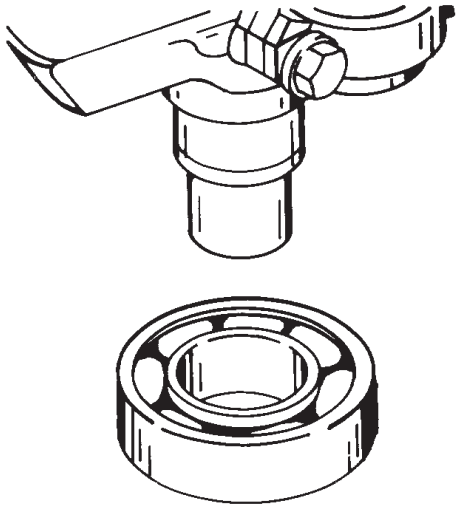
Bearings

BALL BEARINGS

⚠ WARNING

DO NOT spin-dry crankshaft ball bearings with compressed air.

1. Clean ball bearings with solvent and dry with compressed air.
2. Work inner bearing race in and out. There should not be excessive play.
3. Rotate bearing race. Bearing should have smooth action and no rust stains. If ball bearing sounds or feels rough or has catches, remove and discard bearing. Apply light oil to bearing after inspection to prevent rust.

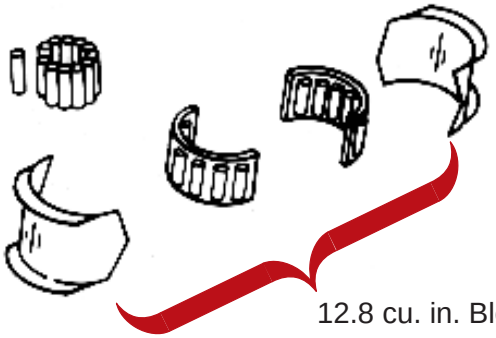


53200

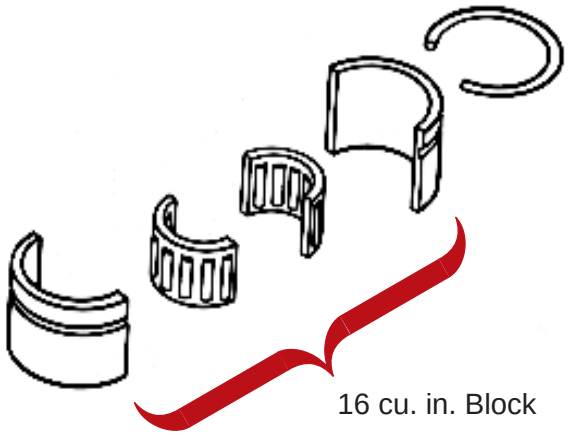
ROLLER BEARINGS

1. Clean roller bearing with solvent and dry with compressed air.
2. Inspect roller bearing for rust, fracturing, wear, galling or overheating (blued). Always replace bearings as a set if replacement is necessary.

3. Apply light oil to bearings after inspection to prevent rust.



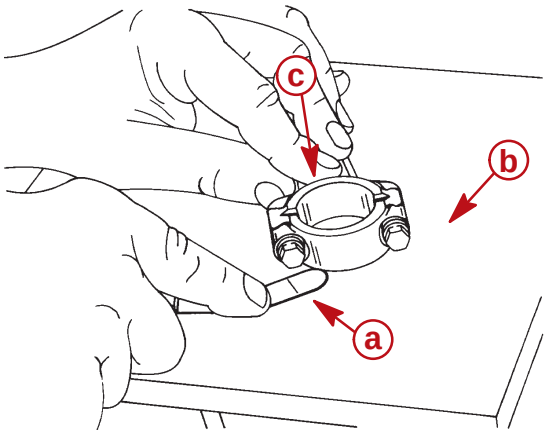
12.8 cu. in. Block



16 cu. in. Block

Connecting Rod

1. Check connecting rods for alignment by placing rods on a surface plate. If light can be seen under any portion of machined surfaces, if rod has a slight wobble on plate, or if a 0.051mm (0.002 in.) feeler gauge can be inserted between any machined surface and surface plate, rod is bent and must be discarded.

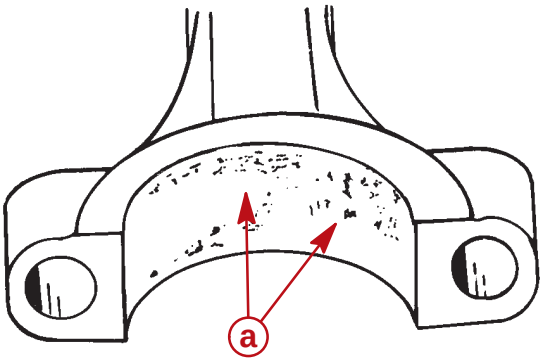


53205

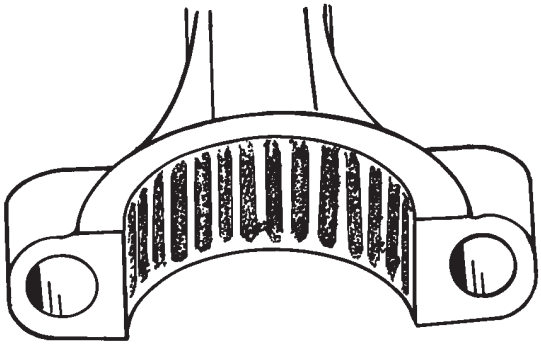
a - Feeler gauge
b - Surface plate
c - Even downward pressure

2. **Overheating:** Overheating is visible as a bluish bearing surface color that is caused by inadequate lubrication or excessive RPM.
3. **Rust:** Rust formation on bearing surfaces causes pits to form on surfaces.

4. **Water Marks:** When bearing surfaces are subjected to water contamination, a bearing surface, etching occurs. This etching resembles the size of the bearing.



51853

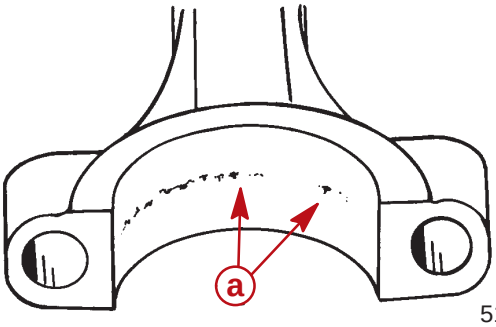


51853

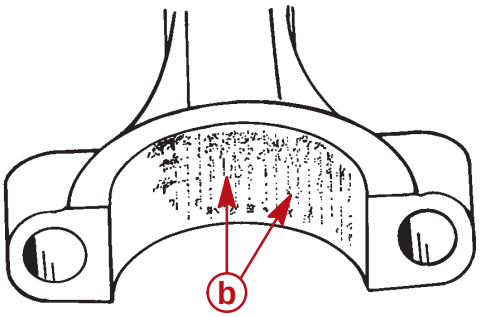
a - Pitting

5. **Spalling:** Spalling is the loss of bearing surface, and it resembles flaking or chipping. Spalling will be most evident on the thrust portion of the connecting rod in line with the I beam. General bearing surface deterioration could be caused by or accelerated by improper lubrication.

6. **Chatter Marks:** Chatter marks are the result of a combination of low speed - low load - cold water temperature operation, aggravated by inadequate lubrication and/or improper fuel. Under these conditions, the crankshaft journal is hammered by the connecting rod. As ignition occurs in the cylinder, the piston pushes the connecting rod with tremendous force, and this force is transferred to the connecting rod journal. Since there is little or no load on the crankshaft, it bounces away from the connecting rod. The crankshaft then remains immobile for a split second until the piston travel causes the connecting rod to catch up to the waiting crankshaft journal, then hammers it. The repetition of this action causes a rough bearing surfaces which resembles a tiny washboard. In some instances, the connecting rod crank pin bore becomes highly polished. During operation, the engine will emit a whirr and/or chirp sound when it is accelerated rapidly from idle speed to approximately 1500 RPM, then quickly returned to idle. If the preceding conditions are found, replace both the crankshaft and connecting rods.



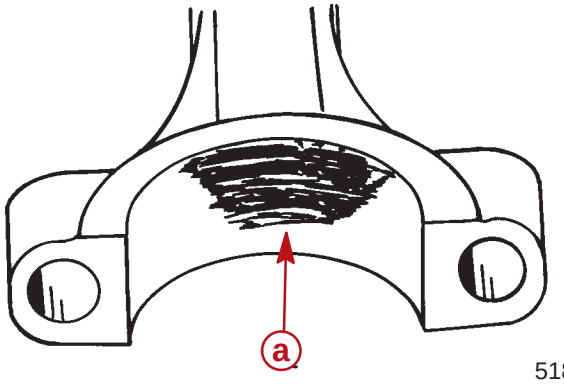
51853



51853

a - Spalling
b - Chatter marks between arrows

7. **Uneven Wear:** Uneven wear could be caused by a bent connecting rod.



a - Uneven wear between arrows

8. If necessary, clean connecting rod bearing surfaces as follows

   a. Be sure that etched marks on connecting rod (crankshaft end) are perfectly aligned with etched marks on connecting rod cap. Tighten connecting rod cap attaching screws securely.

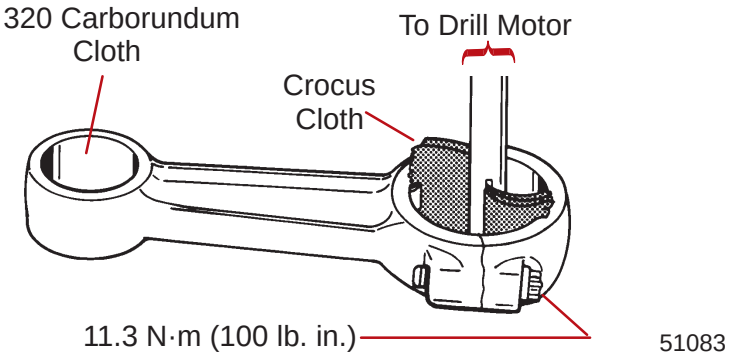
⚠ CAUTION

Crocus cloth MUST BE USED to clean bearing surface at CRANKSHAFT END OF CONNECTING ROD.

320 grit Carborundum cloth MUST BE USED to clean bearing surface at PISTON PIN END OF CONNECTING ROD.

   b. Clean crankshaft end of connecting rod by using CROCUS CLOTH placed in a slotted 9.5 mm (3/8 in.) diameter shaft as shown. Secure shaft in a drill press. Operate press at a high speed while keeping connecting rod at a 90° angle to slotted shaft.

IMPORTANT: Clean connecting rod just enough to clean up bearing surface. DO NOT continue to clean after marks are removed from bearing surface.



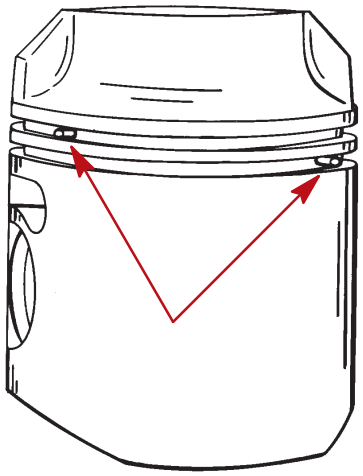
   c. Clean Piston pin end of connecting rod using the same method as in step “b” preceding, but using 320 carborundum cloth instead of crocus cloth.

   d. Thoroughly wash connecting rod to remove abrasive grit. Recheck bearing surface of connecting rod. Replace any connecting rod that cannot be properly cleaned up. Lubricate bearing surfaces of connecting rod with a light oil to prevent rust from forming.

Pistons

IMPORTANT: If engine was submerged while engine was running, piston and/or connecting rod may be bent. If piston pin is bent, piston must be replaced. If piston pin is bent, connecting rod must be checked for straightness.

1. Inspect pistons for scoring and excessive piston skirt wear.
2. Check tightness of piston ring locating pins. Locating pins must be tight.



3. Thoroughly clean pistons. Carefully remove carbon deposits from pistons, with a soft wire brush or carbon removal solution. Do not burr or round off machined edges of ring groves.

Inspect piston ring grooves for wear and carbon accumulation. If necessary, scrape carbon from piston ring grooves. Refer to procedure following for cleaning piston ring grooves.

CLEANING PISTON RING GROOVES

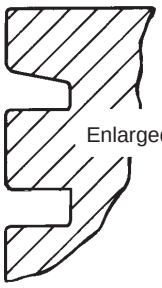
Keystone (tapered) ring grooves

⚠ CAUTION

Care must be taken not to scratch the side surfaces of the ring groove. Scratching the side surface of the ring groove will damage the ring groove.

1. Use a bristle brush and carbon removal solution to remove carbon from side surfaces.
2. A tool can be made for cleaning the inner diameter of the tapered ring grooves. For the top ring groove, break a tapered piston ring. This will enable the inside edge of the ring to reach the inner diameter of the groove. For the bottom ring groove, break a rectangular ring. Carefully scrape carbon from inner diameter of ring grooves. Care must be taken not to damage the grooves by scratching the side surfaces of the grooves.

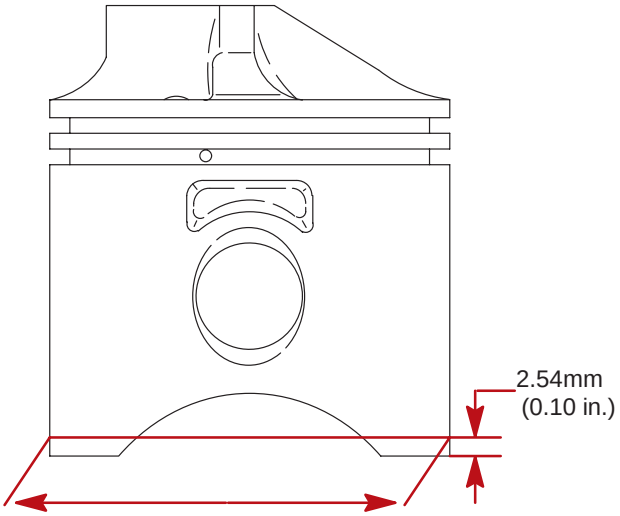
Piston with one (1) half keystone (half tapered) and one (1) rectangular ring.



Enlarged View of Piston Ring Grooves

MEASURING PISTON

1. Measure piston skirt at right angle (90°) to piston pin centerline.



56958

Standard Piston Diameter	
1994 – 6/8/9.9 **1994 – 10/15**	53.92mm (2.123 in.) 60.27mm (2.373 in.)
1995 and newer – 6/8 **9.9/10/15**	53.92mm (2.123 in,.) 60.27mm (2.373 in.)

PISTON CLEARANCE

MINIMUM BORE MEASUREMENT
– MAXIMUM PISTON MEASUREMENT
= PISTON CLEARANCE

PISTON CLEARANCE
0.05MM – 0.13MM (0.002 IN. – 0.005 IN.)

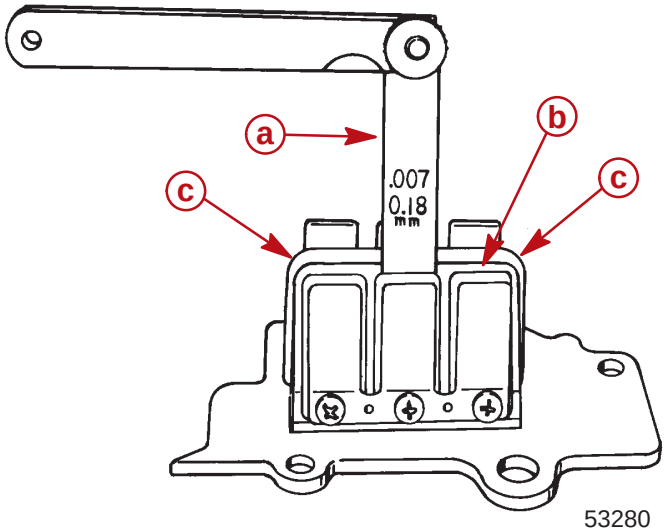
Reed Block

IMPORTANT: DO NOT remove reeds from reed block unless replacement is necessary. DO NOT turn used reeds over for reuse. Replace reeds in sets only.

1. Thoroughly clean reeds and reed block.
2. Check for wear (indentations), cracks or grooves on sealing surfaces of reed block that could cause leakage.
3. Check for chipped or broken reeds.
4. Inspect reed block seal for swelling or looseness. Replace seal if necessary.
5. Replace reeds as necessary.
6. After installing new reeds [having torqued screws to 2.3 Nm (20 lb. in.)], check new reeds as outlined in **Reed Opening** and **Reed Stop Opening** following.

REED OPENING

1. Check reeds for preload and stand open conditions. Stand open should not exceed 0.178mm (0.007 in.). Replace reeds if necessary.

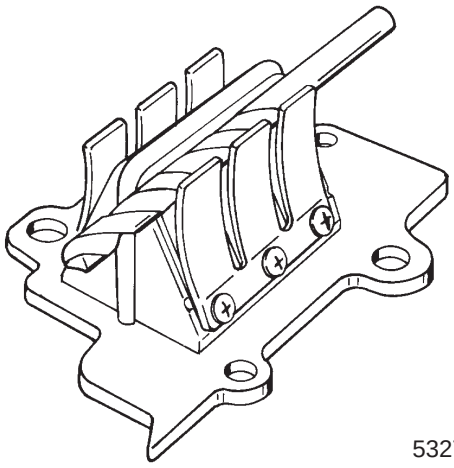


53280

a - Feeler gauge
b - Reed
c - Seal

REED STOP OPENING

Reed stop opening can be checked by placing the appropriate sized drill bit between reeds and reed stops. Carefully bend reed stops if adjustment is necessary.

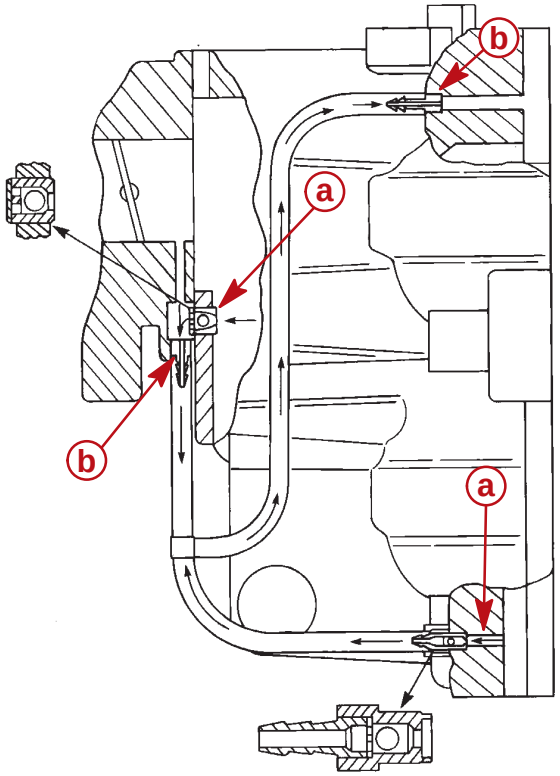


53278

ALL MODELS	7.6mm (19/64 in.)

Bleed System

1. Inspect bleed hoses for deterioration. Replace hoses as required.
2. Inspect bleed check valve in lower crankcase cover for proper function. Valve should flow fuel only one way – from bottom of crankcase cover to top crankshaft bearing via bleed fitting at top of crankcase cover. If check ball in valve is stuck open or closed, replace check valve. Bleed fitting at base of carburetor drains excess fuel which puddles at base of reed block.

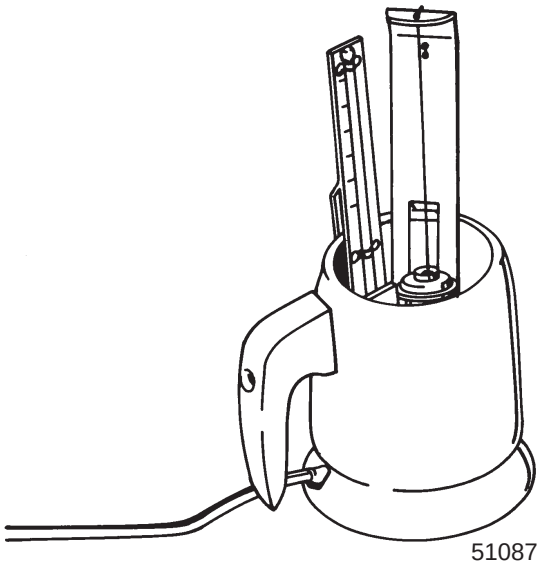


a - Check valve
b - Bleed fitting

Thermostat (If Equipped)

6/8/Work 10 (1999 And Prior)	No Thermostat
6/8/Work 10 (2000 And Newer)	120° Thermostat
9.9/10/15	120° Thermostat

1. Wash thermostat with clean water. Using a thermostat tester, similar to the one shown, test thermostat as follows:
2. Open thermostat valve, then insert a thread between valve and thermostat body. Allow valve to close against thread.
3. Suspend thermostat (from thread) and thermometer inside tester so that neither touches the container. Bottom of thermometer must be even with bottom of thermostat to obtain correct thermostat opening.
4. Fill thermostat tester with water to cover thermostat.
5. Plug tester into electrical outlet.
6. Observe temperature at which thermostat begins to open. Thermostat will drop off thread when it starts to open. Thermostat must begin to open when temperature reaches 3° C (5° F) above designated stamping on bottom of thermostat.
7. Continue to heat water until thermostat is completely open.
8. Unplug tester unit.
9. Replace thermostat, if it fails to open at the specified temperature, or if it does not fully open.



51087

Powerhead Reassembly

General Information

Before proceeding with powerhead reassembly, be sure that all parts to be reused have been carefully cleaned and thoroughly inspected, as outlined in **Cleaning and Inspection**. Parts, which have not been properly cleaned (or which are questionable), can severely damage an otherwise perfectly good powerhead within a few minutes of operation. All new powerhead gaskets must be installed during assembly.

During reassembly, lubricate parts with 2-Cycle Outboard Oil whenever 2-cycle oil is specified, and 2-4-C with Teflon whenever grease is specified.

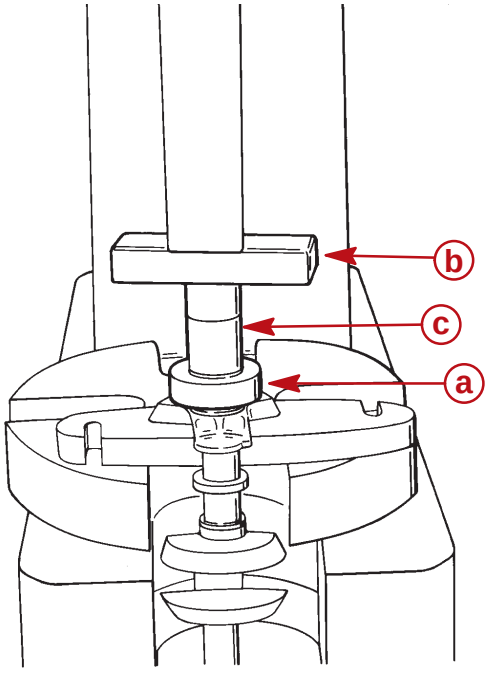
⚠ CAUTION

Any *GREASE* used for bearings *INSIDE* the powerhead MUST BE gasoline soluble. Use only Needle Bearing Assembly Lubricant or 2-4-C with Teflon.

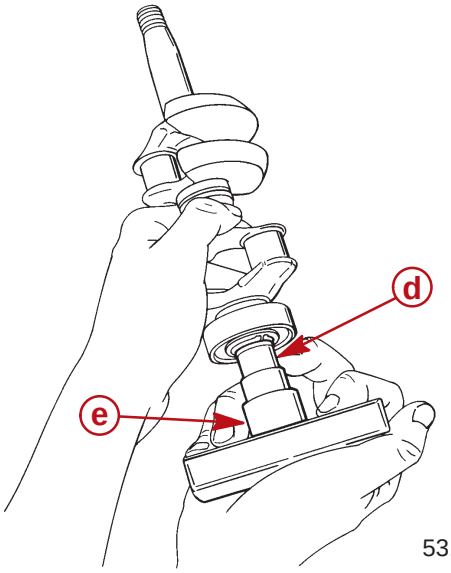
IMPORTANT: A torque wrench is essential for correct reassembly of powerhead. DO NOT attempt to reassemble powerhead without using a torque wrench.

Crankshaft

1. Support crankshaft in press and install lower crankshaft ball bearing (open side of ball retainer facing crank) using powerhead stand with bearing sleeve. Bearing inner race must be firmly seated against crank shoulder.
2. Lubricate O-ring of new coupling seal with 2-4-C with Teflon. Install seal using powerhead stand.



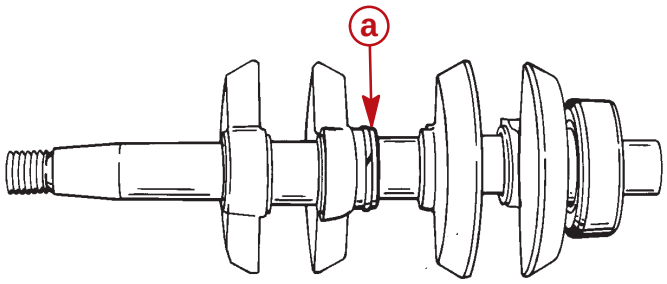
53134



53150

a - Bearing
b - Powerhead Stand (91-13662A1)
c - Sleeve
d - Seal
e - Powerhead Stand

3. Install a new sealing ring.



53130

a - Sealing Ring

NOTE: *It is recommended that the piston pin and piston be installed on the connecting rod prior to installing the connecting rod on the crankshaft to avoid possible bending of the rod during piston pin installation.*

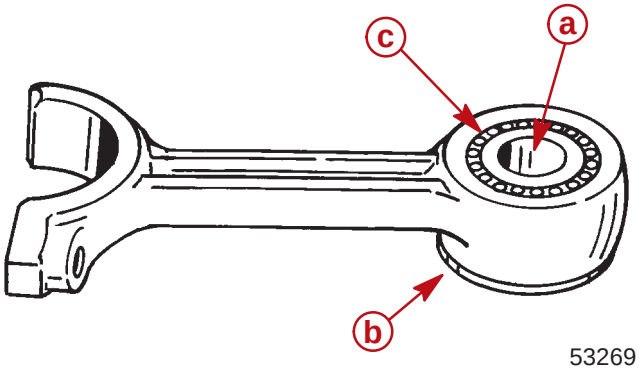
4. Install piston onto connecting rod as follows:

IMPORTANT: When replacing needle bearings, replace all needles as a set. DO NOT use old and new needles together.

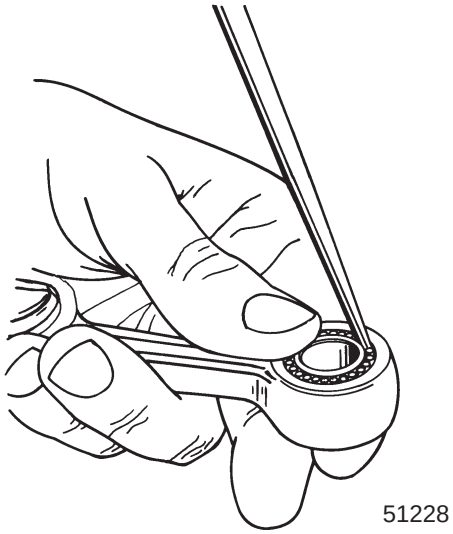
a. Lubricate sleeve of Piston Pin Tool with Needle Bearing Assembly Lubricant or 2-4-C with Teflon.

b. Hold lower locating washer and sleeve onto piston pin bore of connecting rod and install needle bearing set of 24.

NOTE: *If the tip of an awl can be inserted between the needle bearings, one or more needle is missing and must be replaced.*



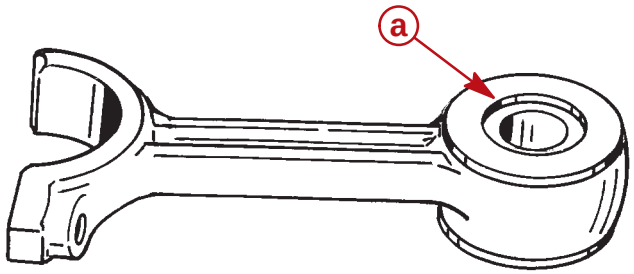
53269



51228

a - Sleeve
b - Locating washer
c - Needle bearings (24)

c. Install upper locating washer.



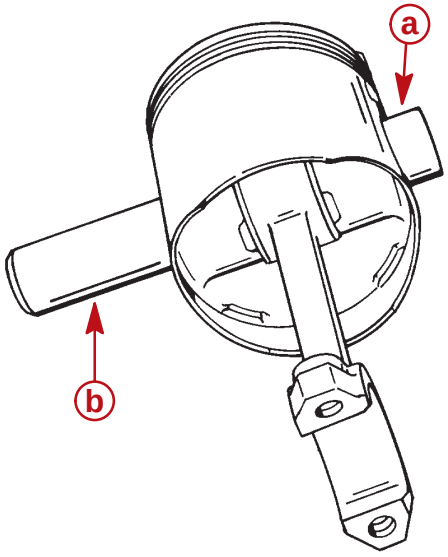
53267

a - Locating washer

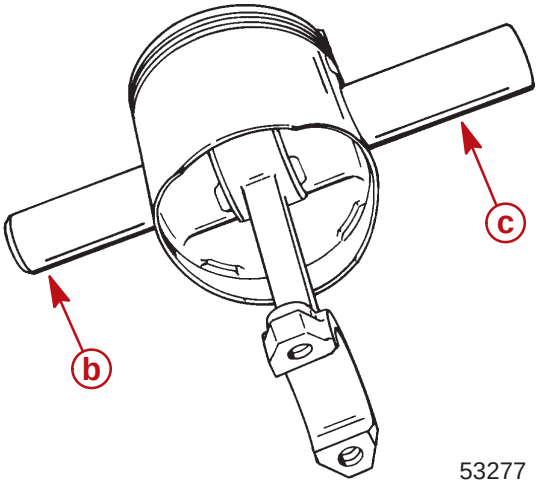
d. Slide piston onto connecting rod, centering piston pin bore over sleeve.

e. Slide piston tool up through piston pin bore and remove sleeve.

f. Apply light oil to piston pin and place piston pin onto tool.



53275



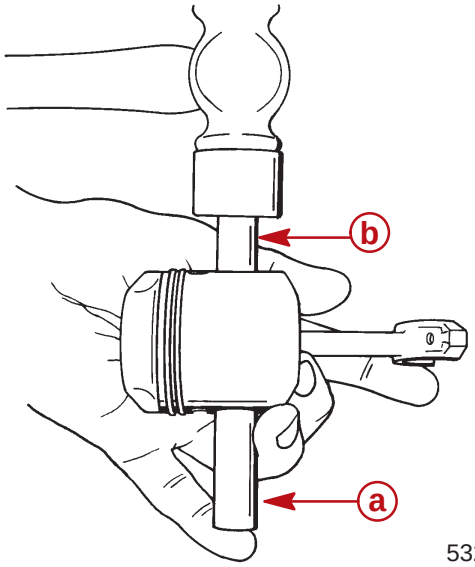
53277

a - Sleeve
b - Piston Pin Tool (91-13663A1)
c - Piston pin

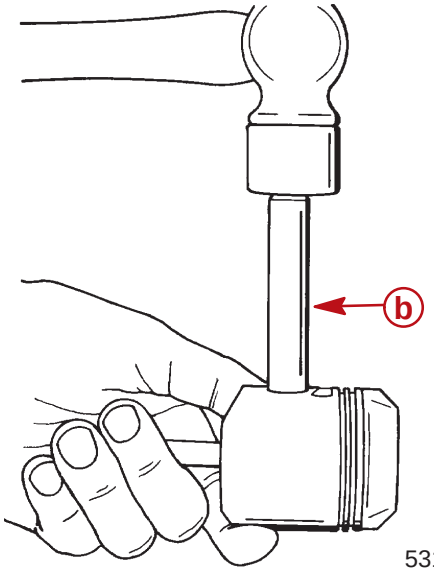
g. Support bottom of piston and hold piston pin tool up against piston pin.

h. Drive piston pin into piston pin bore (with a soft face mallet) until pin is flush with piston.

i. Move piston pin tool to top of piston pin bore and center piston pin in piston.



53276



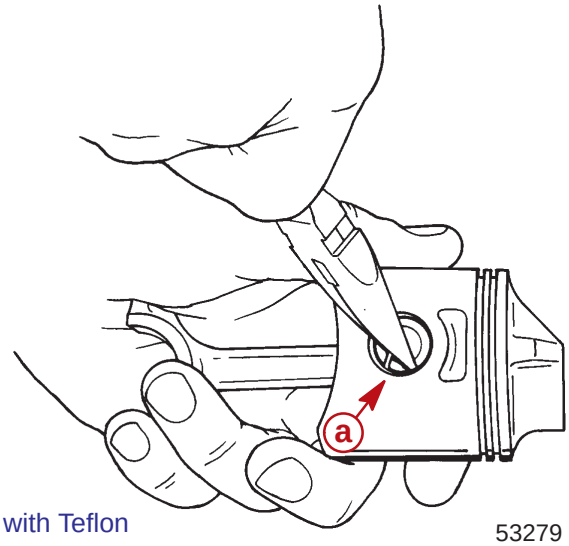
53143

a - Piston Pin Tool (91-13663A1)
b - Piston pin

5. Install new lockrings into grooves in both ends of piston pin bore.
6. Install connecting rods onto crankshaft as follows:
   a. Apply 2-4-C with Teflon to connecting rod big-end bearings.

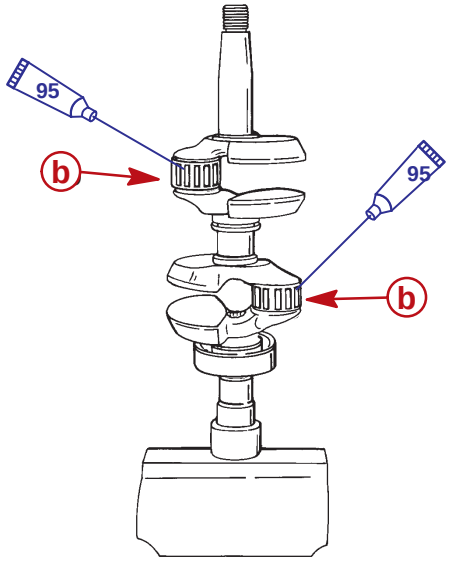
IMPORTANT: Replace roller bearing halves as a set. DO NOT use old and new halves together.

   b. Place both halves of connecting rod big-end roller bearing onto crank pin.



53279

95 2-4-C with Teflon

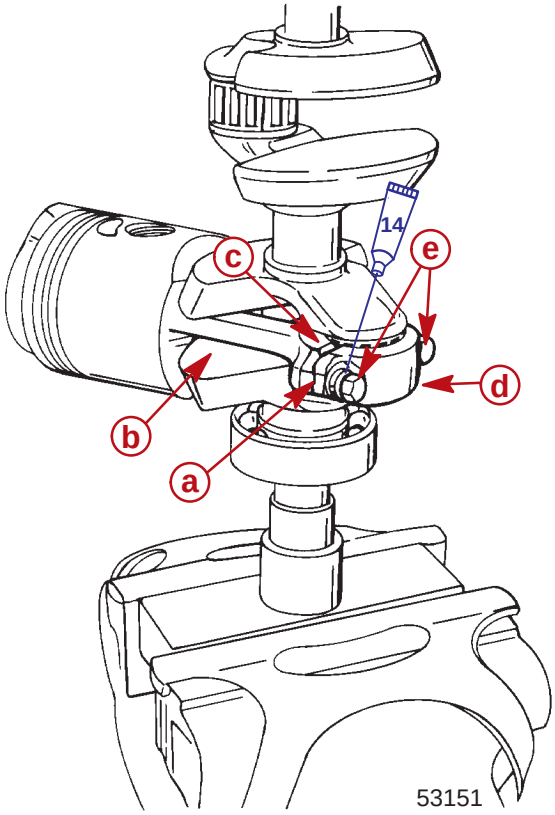


53132

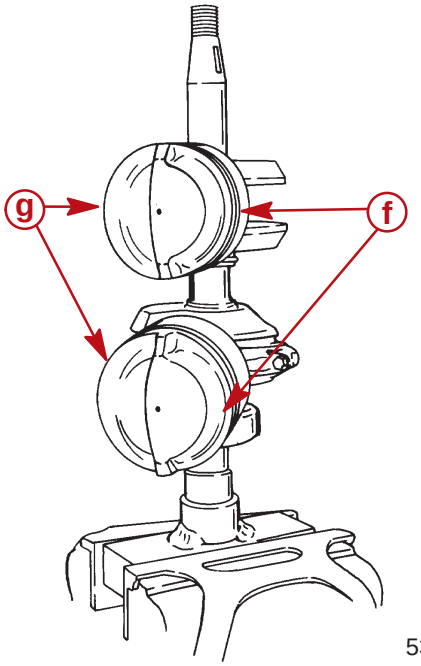
a - Lockring
b - Roller bearing

IMPORTANT: Clean connecting rod bolts with solvent and dry with compressed air. Inspect threads for damage. If threads are not damaged, bolts may be reused. Apply light oil to threads prior to installation.

c. Observe connecting rod/cap fracture line for correct alignment. Secure connecting rod (with v-notch of rod toward flywheel end of crankshaft) onto crankshaft with rod cap and bolts. Torque bolts to 11.3 Nm (100 lb. in.).



53151

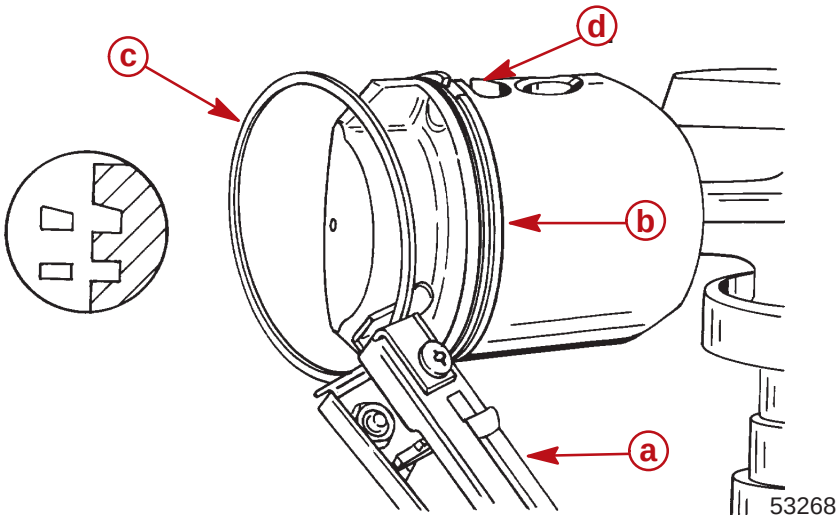


53138

14 2 Cycle Premium Outboard Oil

a - Fracture line
b - Connecting rod
c - V-notch (Ttoward flywheel)
d - Rod cap
e - Bolts [Torque to 11.3 Nm (100 lb. in.)]
f - Intake side
g - Exhaust side

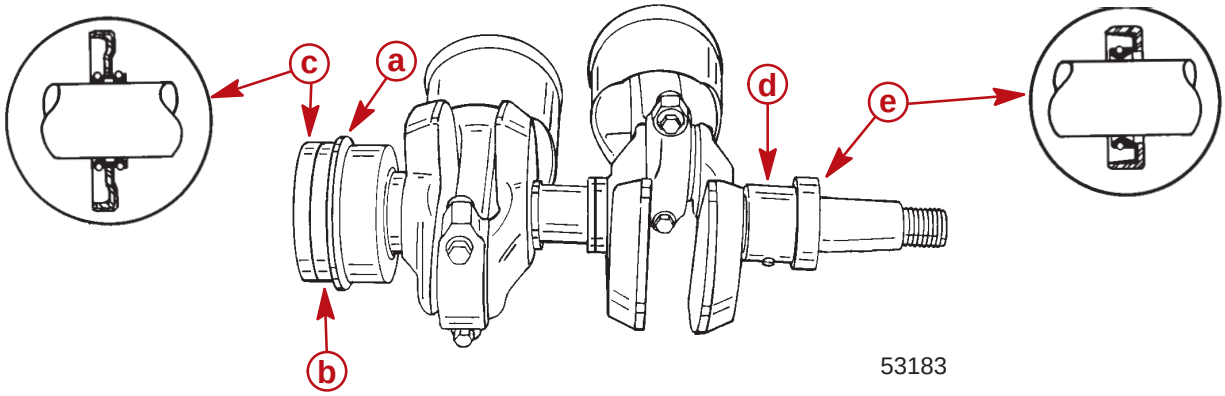
7. Install new piston rings using Piston Ring Expander. Install RECTANGULAR ring first in bottom ring groove. Install HALF-KEYSTONE ring in top ring groove. Align piston rings with ring locating pins.



a - Piston Ring Expander (91-24697)
b - Rectangular ring
c - Half-keystone ring
d - Locating pin

IMPORTANT: Chamfered side of retaining ring faces away from lower crankshaft ball bearing.

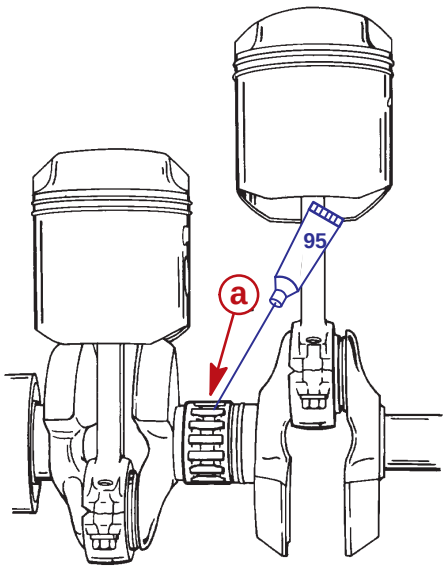
8. Install retaining ring, stuffer washer and lower crankshaft oil seal.
9. Install upper crankshaft roller bearing and oil seal.



a - Retaining ring
b - Stuffer washer
c - Lower oil seal
d - Roller bearing
e - Upper oil seal

IMPORTANT: When replacing roller bearing halves, replace both halves together.

10. Apply 2-4-C with Teflon to center main bearing surface of crankshaft and install center main roller bearing halves.



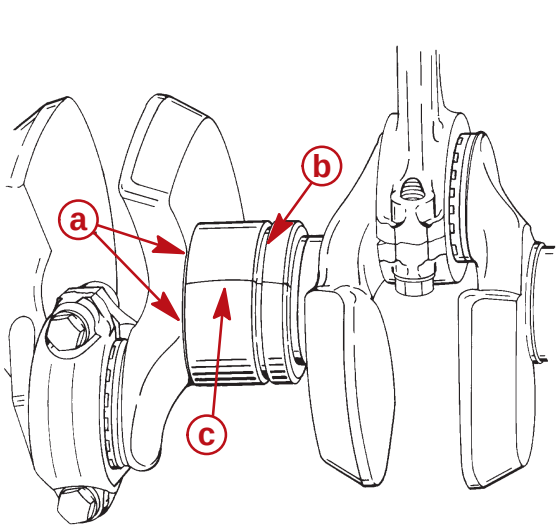
53133

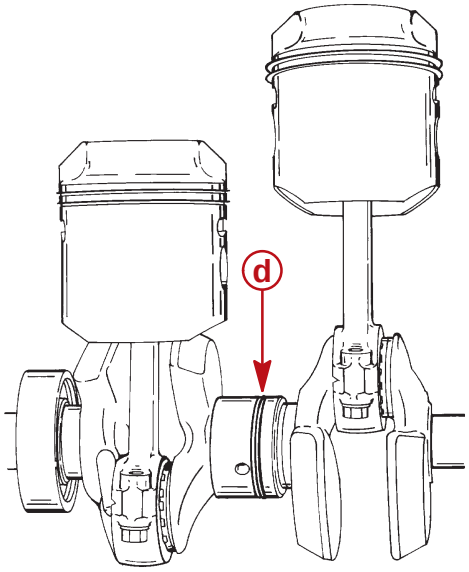
95 2-4-C with Teflon

a - Bearing halves

11. **Model 10 and 1995 and newer Model 9.9:** Position center main bearing race halves (retaining ring groove toward flywheel end of crankshaft) around center main roller bearing. Make sure fracture lines of race halves are correctly mated.

12. Secure center main bearing race halves together with retaining ring. Verify retaining ring bridges both fracture lines of bearing race.





53127

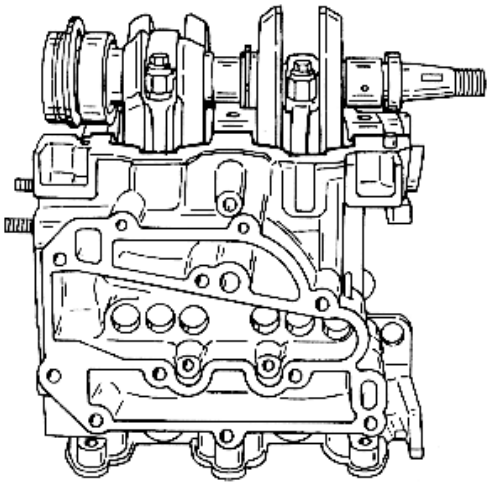
a - Bearing race halves
b - Retaining ring groove
c - Fracture lines
d - Retaining ring

Cylinder Block

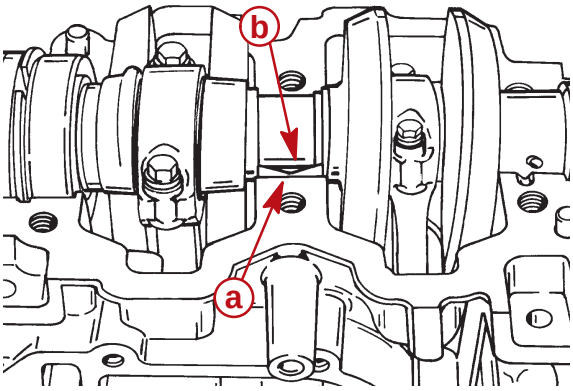
1. Lubricate piston rings, piston and cylinder wall with light oil.

IMPORTANT: DO NOT seat crankshaft fully into block until center main sleeve and bearing half are installed.

2. Keeping crankshaft horizontal, guide pistons into cylinder bores.



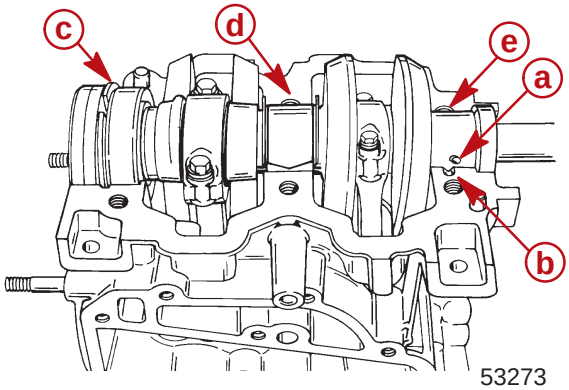
3. **1994 Model 9.9 and all Model 6/8:** Install 1/2 of center main bearing sleeve and bearing into cylinder block.



53272

a - Bearing sleeve
b - Bearing

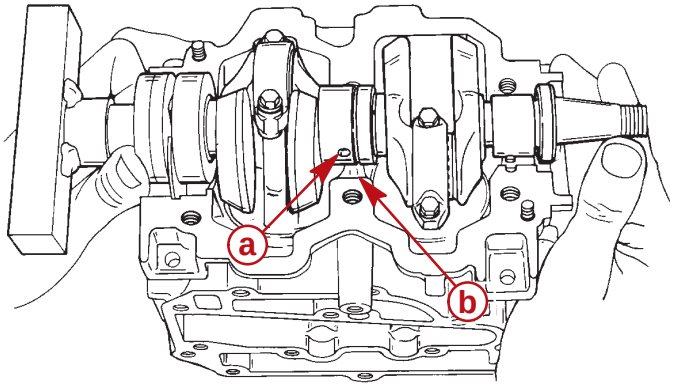
4. **1994 Model 6/8/9.9 and 1995 Model 6/8:** Install 2nd half of center main sleeve and bearing.



53273

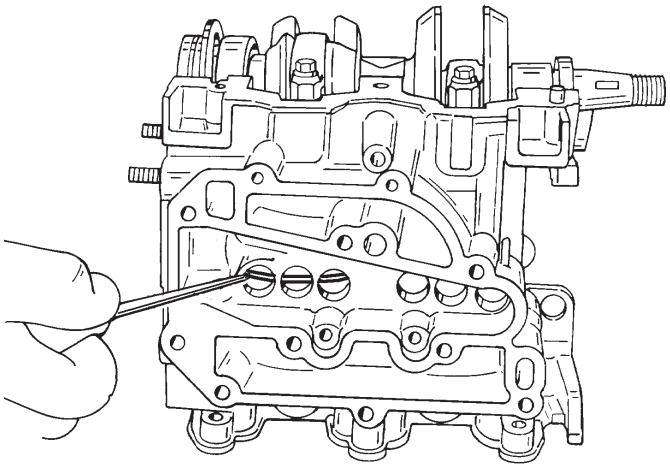
a - Alignment boss
b - Notch
c - Retaining ring
d - Sleeve
e - Bearing

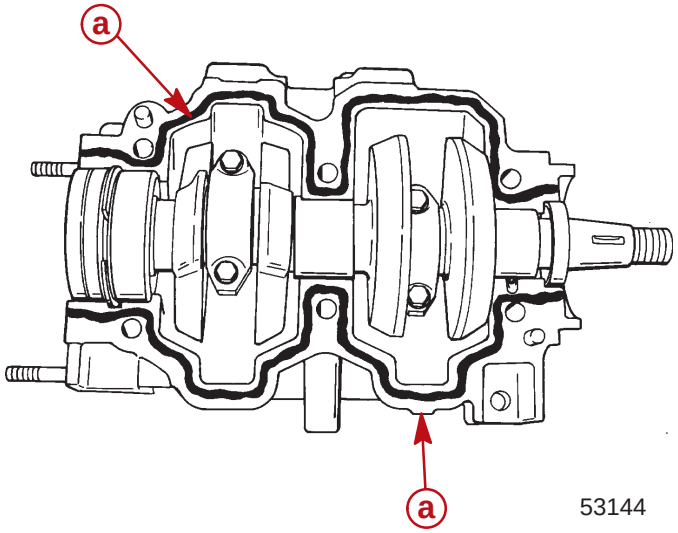
5. **Model 10/15 and 1995 and newer Model 9.9:** Align hole in center main bearing race with pin of cylinder block.



a - Hole
b - Pin (hidden)

6. Position alignment boss of upper crankshaft roller bearing into notch in cylinder block.
7. Firmly press retaining ring (bevel faces DOWN) into groove in cylinder block and gently seat crankshaft assembly into position.
8. Gently push seals inward to seat.
9. Check each piston ring for spring tension through transfer and exhaust ports by pressing with a screwdriver. If no spring tension exists (ring fails to return to position), it is likely that the piston ring was broken during assembly [replace broken piston rings]. Use caution not to burr piston rings while inspecting.
10. Clean crankcase sealing surfaces according to Loctite Master Gasket instructions. Apply a continuous bead of Loctite sealant along the inside of the mounting bolt holes of crankcase cover.


53124

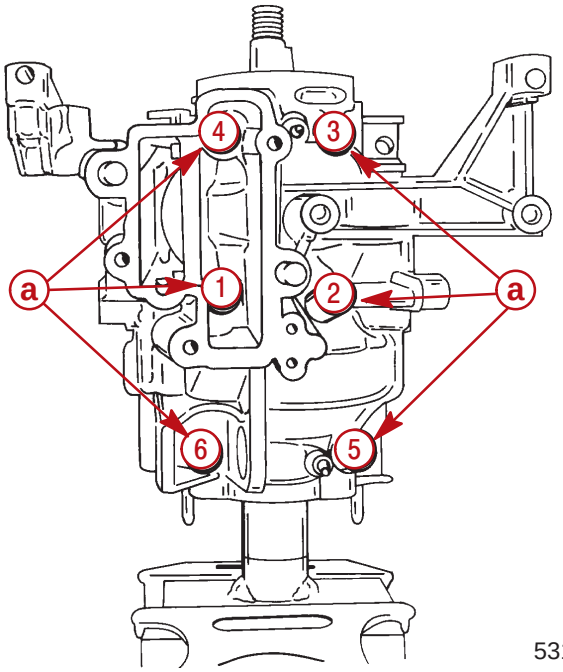


53144

a - Sealant

IMPORTANT: For 1994 Model 9.9 and all Models 6/8, split line of center main bearing sleeve halves MUST ALIGN when crankcase cover is installed onto cylinder block.

11. Place crankcase cover onto cylinder block and secure with 6 bolts. Torque bolts to 22.7 Nm (16.7 lb. ft.) in numbered torque sequence.



53192

a - Bolts [Torque to 22.7 Nm (16.7 lb. ft.)]

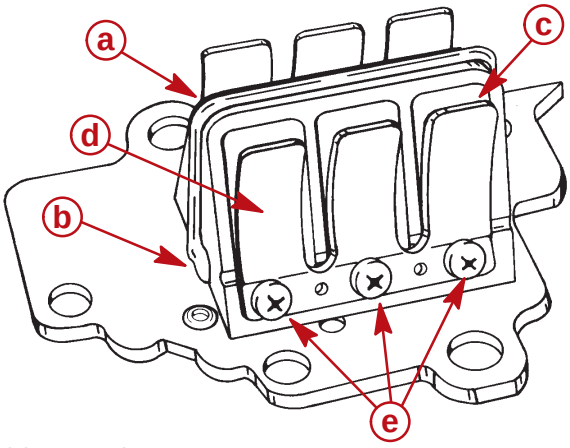
12. Rotate crankshaft several times to assure free operation.

13. If disassembled, assemble reed block as follows:

    a. Pull ends of rubber seal into holes in intake manifold/reed block. Trim off installation tabs from rubber seal and apply RTV Silicone Sealer at each location where seal passes through manifold.

NOTE: *1997 and newer reed blocks are rubber coated and do not require sealant.*

    b. Secure reeds and reed stops to intake manifold/reed block with 6 screws. Torque screws to 2.3 Nm (20 lb. in.).

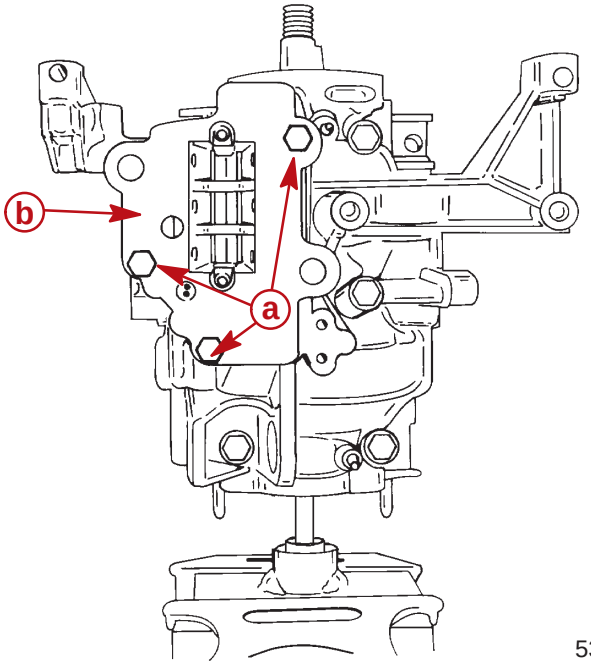


53202

a - Rubber seal
b - Apply sealant (each side)
c - Reeds
d - Reed stops
e - Screws [Torque to 2.3 Nm (20 lb. in.)]

14. **1996 Models and prior:** Apply 2-4-C with Teflon to rubber seal (to prevent seal from moving out of position) and secure intake manifold/reed block (with new gasket) using 3 bolts.

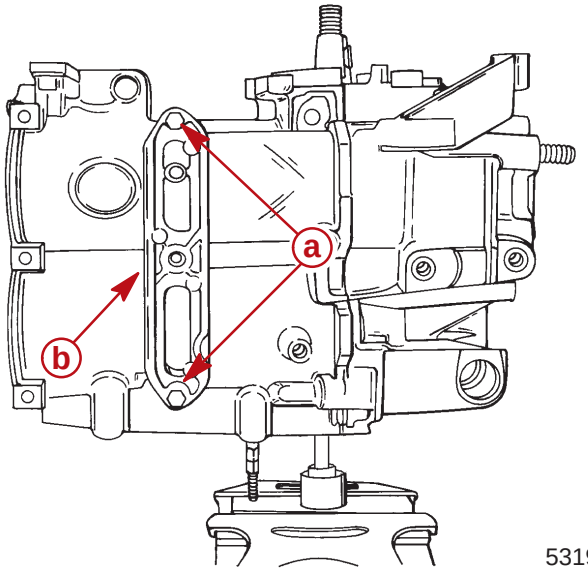
ALL Models: Torque bolts to 6.8 Nm (60 lb. in.).



53191

a - Bolts [Torque to 6.8 Nm (60 lb in.)]
b - Intake manifold/reed block

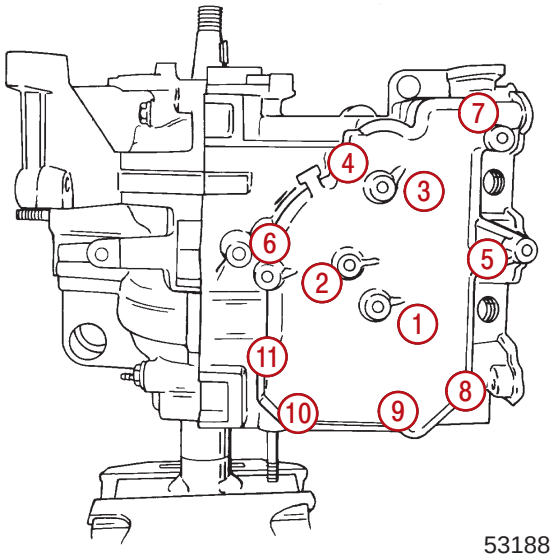
15. **1994 Models:** Secure intake cover (with new gasket) using 2 bolts.
1995 Models and newer: Inspect O-rings on intake cover for cuts or abrasions. Replace if necessary. Secure cover with 2 bolts. Torque bolts to 6.8 Nm (60 lb. in.).



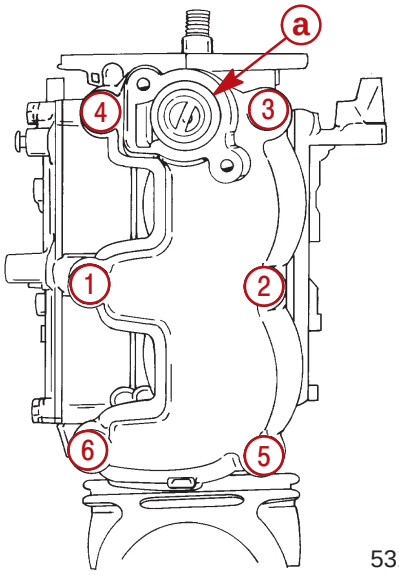
53198

a - Bolts [Torque to 6.8 Nm (60 lb. in.)]
b - Intake cover

16. Secure exhaust manifold and cover (with new gaskets) using 11 bolts. Torque bolts to 6.8 Nm (60 lb. in.) in torque sequence listed.
17. Secure cylinder block cover to block with 6 bolts. Torque bolts to 6.8 Nm (60 lb. in.) in sequence shown. Install thermostat, if equipped.



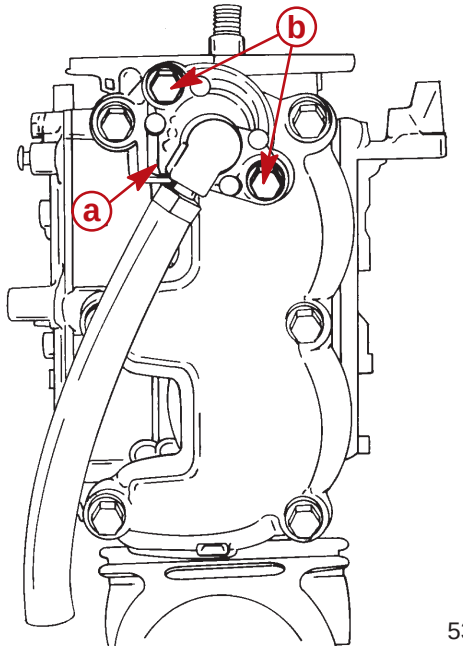
53188



53193

a - Thermostat

18. Install thermostat cover. Torque bolts to 6.8 Nm (60 lb. in.).



53194

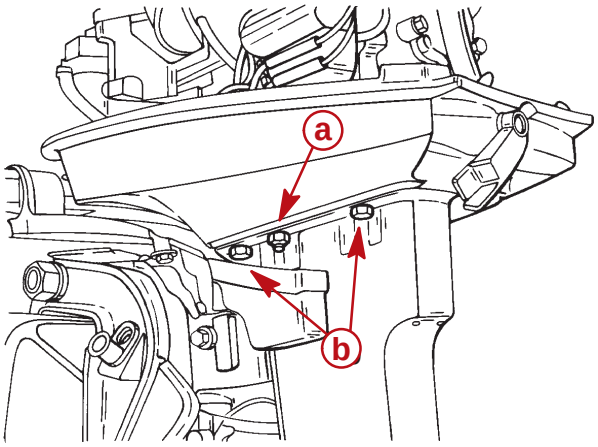
a - Cover
b - Bolts [Torque to 6.8 Nm (60 lb. in.)]

19. Install the following components/assemblies referring to the listed service manual sections.

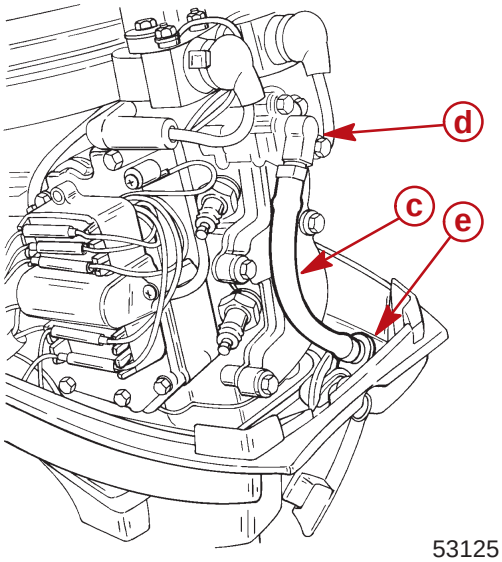
Component/Assembly	Section
Carburetor	3
Throttle/Shift Mechanism	7A/B/C
Electrical/Ignition Components and Flywheel	2A/B
Rewind Starter	8

Powerhead Installation

1. Verify powerhead base surface and driveshaft housing mating surfaces are free of old gasket material.
2. Secure powerhead (with new gasket) onto driveshaft housing using 4 bolts and 2 nuts. Apply Loctite 680 Retaining Compound to threads of bolts. Torque bolts and nuts to 11.3 Nm (100 lb. in.).
3. Attach tell-tale hose to thermostat cover and fitting on bottom cowl.



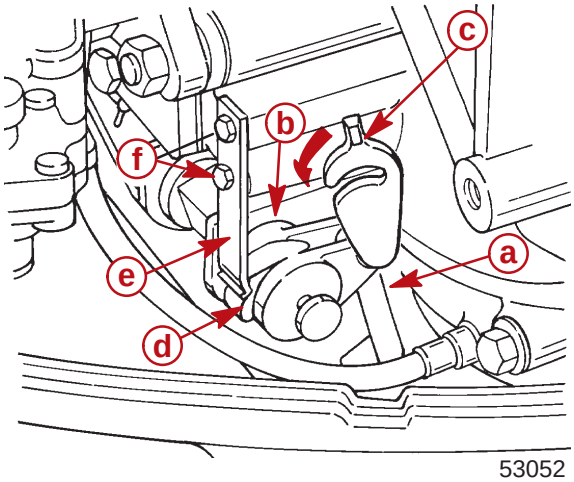
53204



53125

a - Bolts (2 each side) [Torque to 11.3 Nm (100 lb. in.)]
b - Nuts (1 each side) [Torque to 11.3 Nm (100 lb. in.)]
c - Tell-tale hose
d - Thermostat cover
e - Cowl fitting

4. Secure end of shift shaft to yoke of horizontal shift shaft with lever.



53052

a - Shift shaft
b - Yoke
c - Lever
d - Apply 2-4-C with Teflon
e - Detent spring
f - Bolts [Torque to 2.8 Nm (25 lb. in.)]

Set-Up and Test-Run Procedures

⚠ CAUTION

When engine is started, IMMEDIATELY check for fuel leaks and water leaks. Check for water pump operation by water being discharged from tell-tale.

1. Following powerhead repairs, refer to Section 2C Timing/Synchronizing/Adjusting to perform set-up procedures.
2. While test running engine, check powerhead assembly for leaks and/or unusual noises. Make any repairs BEFORE returning engine to service.

Break-In Procedure

⚠ CAUTION

To avoid possible engine damage, break-in procedure MUST BE completed BEFORE operating engine continuously at full throttle. Failure to break-in engine in properly will result in engine failure or shortened powerhead life.

IMPORTANT: Advise the owner that the break-in procedure must be followed EXACTLY when returning an overhauled engine to service.

1. Mix gasoline and oil at the normal 50:1 ratio.
2. Operate engine at varied throttle settings for the first hour (1 hour). AVOID both wide-open-throttle operation and prolonged idle in cold water areas during this period.
3. After the first hour of operation, the engine is ready for normal operation and may be run at any speed. DO NOT EXCEED the full throttle RPM range listed in **Specifications**, preceding.

MID-SECTION

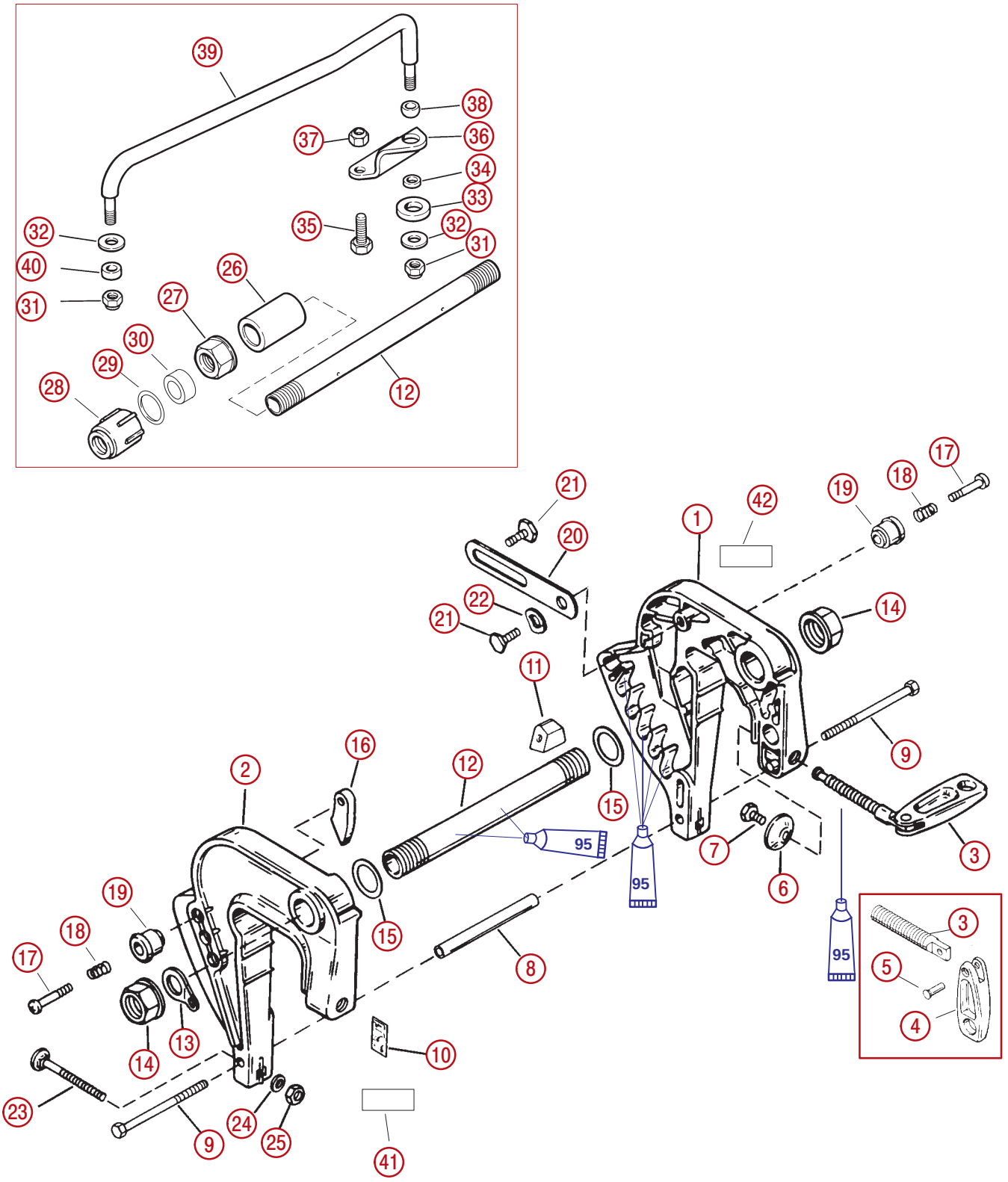
Section 5A – Clamp/Swivel Brackets and Drive Shaft Housing

Table of Contents

Clamp Bracket 5A-2
Swivel Bracket 5A-4
Drive Shaft Housing 5A-6
Drive Shaft Housing Disassembly Reassembly 5A-7

5 A

Clamp Bracket

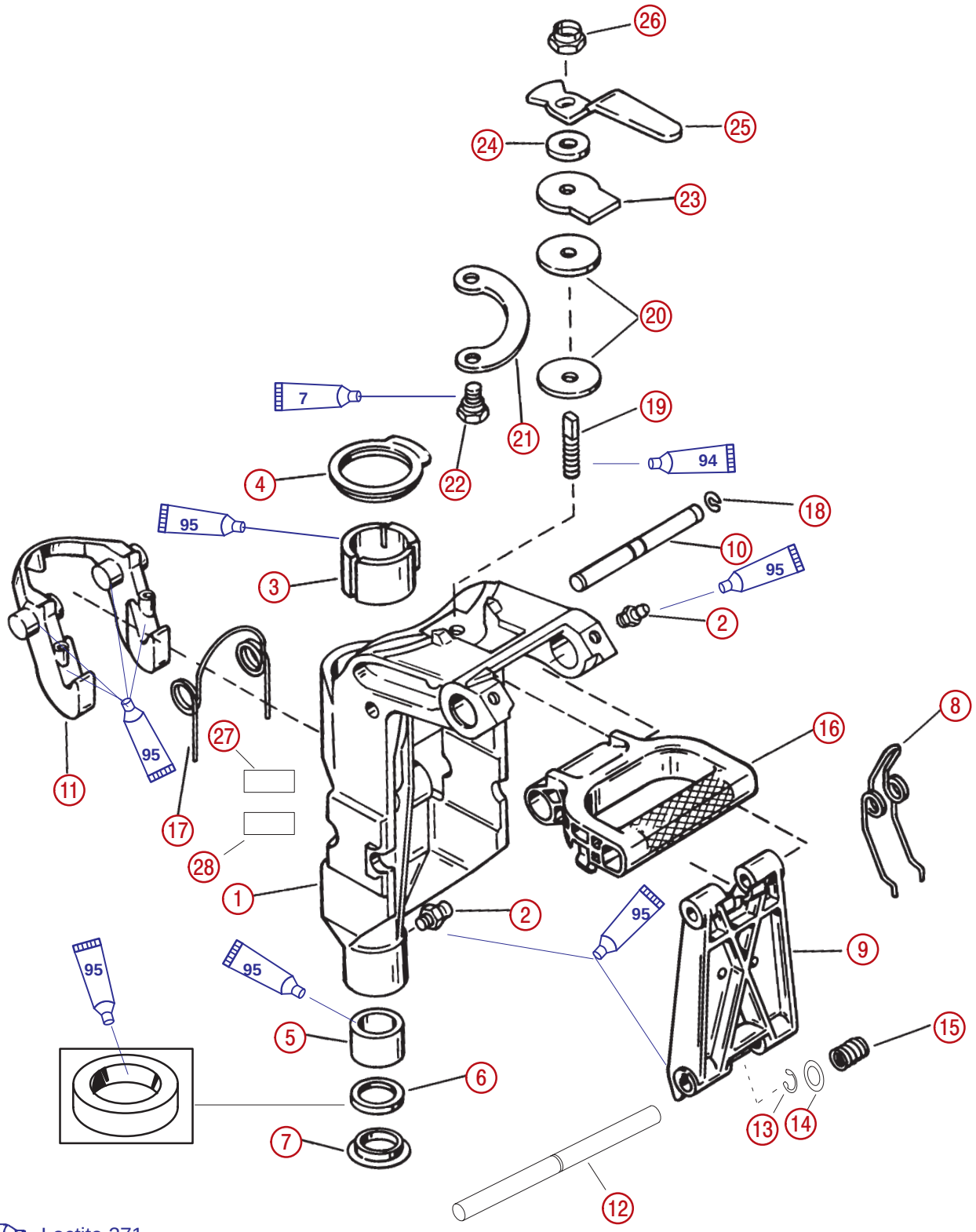


95 2-4-C with Teflon

Clamp Bracket (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CLAMP BRACKET **(BLACK-PORT)**			
2	1	CLAMP BRACKET **(BLACK-STARBOARD)**			
3	2	THUMB SCREW ASSEMBLY			
4	2	HANDLE			
5	2	RIVET			
6	2	WASHER–thumb screw			
7	2	SCREW–washer attaching	65		7.3
8	1	SPACER			
9	2	SCREW (M6 x 40)	60		6.8
10	1	DECAL (TILT)			
11	1	SHUTTLE–tilt lock			
12	1	TILT TUBE **(HANDLE MODELS)**			
	1	TILT TUBE **(RC MODELS)**			
13	1	CLIP–safety			
14	2	NUT–tilt tube	120		13.6
15	2	WASHER–tilt tube			
16	2	LEVER ASSEMBLY–tilt return			
17	2	SCREW (M5 x 35)			
18	2	SPRING			
19	2	KNOB			
20	1	STRAP–tilt stop - port side			
21	2	SCREW–strap to clamp bracket	60		6.8
22	1	WAVE WASHER–tilt stop strap screw			
23	2	BOLT–clamp bracket to transom (1/4-20 x 3-1/2)			
24	2	WASHER–clamp bracket bolt			
25	2	NUT–clamp bracket bolt			
26	1	SPACER			
27	2	NUT			
28	1	SEAL			
29	1	O RING			
30	1	SPACER **RC MODELS**			
31	2	NUT			
32	3	WASHER **(.625 O.D.)**			
33	1	WASHER			
34	1	WASHER			
35	2	SCREW (M8 x 30)			
36	1	BRACKET			
37	2	NUT			
38	1	BALL JOINT			
39	1	TIE ROD			
40	1	SPACER			
41	1	DECAL-Lower Tilt Limit			
42	1	DECAL-Tilt Lock			

Swivel Bracket



7 Loctite 271

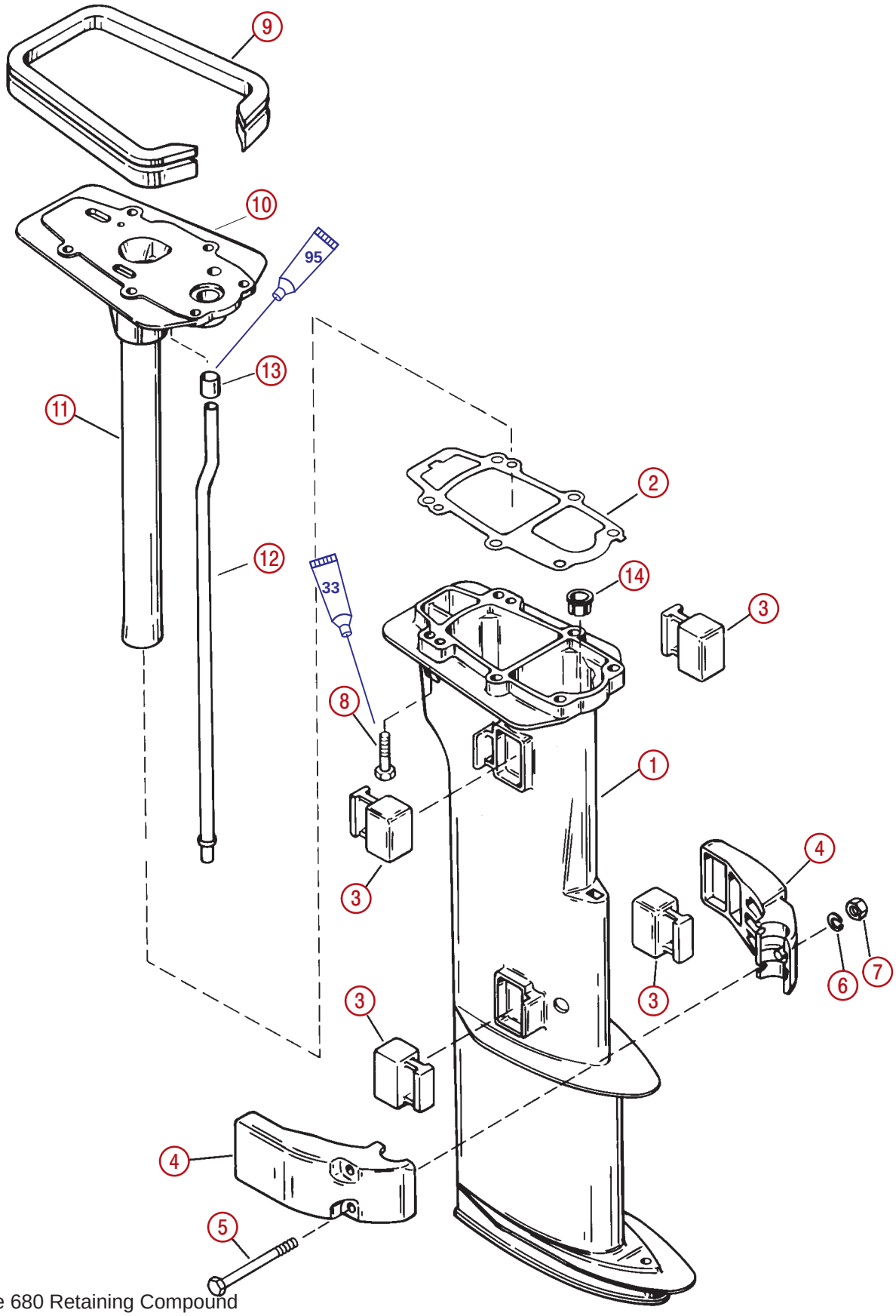
94 Anti-Corrosion Grease

95 2-4-C with Teflon

Swivel Bracket (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	SWIVEL BRACKET **(BLACK)**			
2	3	GREASE FITTING			
3	1	BEARING			
4	1	THRUST BEARING–upper			
5	1	BUSHING–lower			
6	1	SEAL			
7	1	THRUST WASHER–lower			
8	1	SPRING			
9	1	BRACKET			
10	1	PIN			
11	1	HOOK–reverse lock			
12	1	PIVOT PIN			
13	1	RETAINING RING			
14	1	WASHER			
15	1	SPRING			
16	1	CARRYING HANDLE **(BLACK)**			
17	1	SPRING–reverse hook			
18	2	E-RING			
19	1	ROD			
20	2	BRAKE DISC			
21	1	SWIVEL HEAD PLATE			
22	2	SCREW (M6 x 13)	70		7.9
23	1	BRAKE PLATE			
24	1	WASHER			
25	1	HANDLE			
26	1	NUT	125		14.1
27	1	DECAL–co-pilot			
28	1	DECAL-Serial Overlaminate			

Drive Shaft Housing



33 Loctite 680 Retaining Compound

95 2-4-C With Teflon

Drive Shaft Housing (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	HOUSING ASSEMBLY **(BLACK-SHORT)**			
	1	HOUSING ASSEMBLY **(BLACK-LONG)**			
2	1	GASKET–drive shaft housing			
3	4	MOUNT			
4	2	COVER–mount **(BLACK)**			
5	2	SCREW–mount cover (M6 x 80)			
6	2	WASHER			
7	2	NUT–cover screw	110		12.4
8	4	SCREW (M6 x 35)	100		11.3
9	1	SEAL–adaptor plate			
10	1	ADAPTOR PLATE **(NO EXHAUST TUBE)(6/8/9.9)**			
	1	ADAPTOR PLATE **(WITH EXHAUST TUBE) (15)**			
11	1	EXHAUST TUBE **(15)**			
12	1	WATER TUBE **(SHORT)**			
	1	WATER TUBE **(LONG)**			
13	1	SEAL–water tube			
14	1	BEARING BLOCK **(LONG)**			

Drive Shaft Housing Disassembly/Reassembly

Servicing components such as steering arm, drive shaft housing, exhaust assembly and swivel bracket will usually require powerhead and/or gear housing removal.

Refer to SECTION 4 for powerhead removal and SECTION 6 for gear housing removal.

NOTE: *With powerhead removed, always inspect and remove any carbon buildup in exhaust tube.*

The transom bracket, lower mount bracket, tilt tube and lower engine mounts can be serviced without powerhead/gear housing removal. However, OUTBOARD MUST BE SUPPORTED BEFORE SERVICING COMPONENTS.

IMPORTANT: All gaskets should be replaced when removing powerhead and/or disassembling drive shaft housing. Corresponding gasket mating surfaces should be cleaned of any gasket material before installing new gaskets.

MID-SECTION

Section 5B – Power Trim

Table of Contents

Table of Contents 5B-1
Specifications 5B-1
Special Tools 5B-1
Power Trim Components 5B-2
Power Trim – General Information 5B-4
Troubleshooting 5B-5
Hydraulic Troubleshooting 5B-5
Electrical Troubleshooting 5B-5
Power Trim Relay Test Procedure 5B-6
Remote Control 5B-7
Tiller Handle 5B-8
General Checks 5B-9
Troubleshooting the Down Circuit 5B-9
Troubleshooting the Up Circuit 5B-10
Troubleshooting the Down and Up Circuits (All Circuits Inoperative) 5B-11
Power Trim 5B-12
Cylinder Removal 5B-12
Cylinder Assembly/Installation 5B-14
Hydraulic Pump 5B-16
Removal 5B-16
Installation 5B-17
Filling Hydraulic Reservoir 5B-17

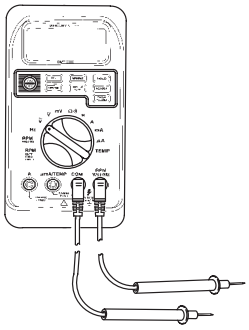
5 B

Specifications

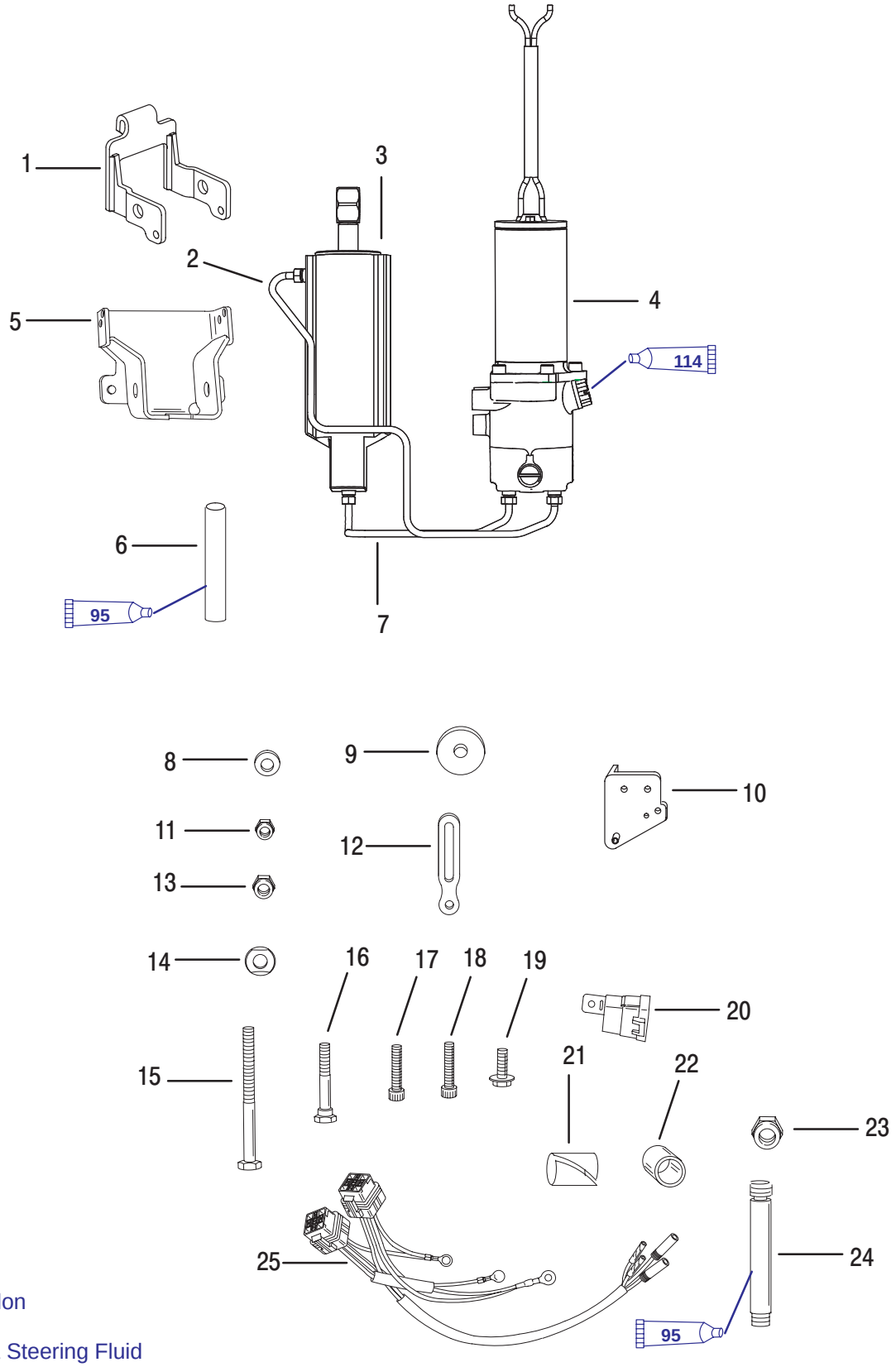
Total Trim Degrees	56°
Required Voltage	12V
Minimum Battery Size	335Marine Cranking Amperes (260 Cold Cranking Amperes)

Special Tools

1. DMT 2000 Digital Tachometer Multi-meter P/N 91-854009A1



Power Trim Components



95 2-4-C with Teflon

114 Power Trim & Steering Fluid

Power Trim Components (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
15	1	UPPER BRACKET			
16	1	LINE, HYDRAULIC			
17	1	CYLINDER			
18	1	HYDRAULIC PUMP			
19	1	LOWER BRACKET			
20	1	PIVOT PIN, UPPER			
21	1	LINE, HYDRAULIC			
22	2	WASHER .281 X .625			
23	2	WASHER .344			
24	1	MOUNTING PLATE			
25	6	NUT (.250-28)	144		16.3
26	1	TILT STOP STRAP			
27	2	NUT (.312-18)			
28	1	WAVE WASHER			
29	2	BOLT .(312-18 X 3.50)			
30	2	BOLT (.250-28 X 1.75)	144		16.3
31	2	BOLT (.250-28 X 1.25)	144		16.3
32	2	BOLT (.250-28 X 1.50)	144		16.3
33	3	BOLT (.250-20 X .625)	80		9
34	2	TRIM RELAY			
35	1	NYLON BUSHING, LOWER CYLINDER			
36	2	PIN SPACER, LOWER CYLINDER			
37	2	NUT LOCKING (.500 X 20)	120		13.6
38	1	PIVOT PIN , LOWER			
39	1	HARNESS			

Power Trim – General Information

DESCRIPTION

The Power Trim System consists of an electric motor, fluid reservoir, pump and a trim/tilt cylinder.

The remote control (or trim panel) has switches that trim the outboard UP or DOWN and tilt the engine for Trailering. The outboard can be trimmed and tilted while under power or when the outboard is not running.

TRIMMING CHARACTERISTICS

NOTE: *Because hull designs react differently in varying water conditions, Varying the trim position will often improve the ride and boat handling.*

TRIMMING UP (OUT)

⚠ WARNING

Excessive trim OUT may cause steering instability resulting in loss of operational control.

Trimming UP will lift the boat bow, increase the boat speed, may increase steering torque to the port, increases gearcase clearance over submerged objects, and/or can cause boat to porpoise and/or ventilation.

TRIMMING DOWN (IN)

⚠ WARNING

Excessive trim IN may cause undesirable and/or unsafe steering conditions.

Trimming DOWN aids in planing particularly with heavy loads, improves ride in choppy water, can cause bow steering (boat veers to left or right), and/or improves acceleration to planing speed.

Troubleshooting

IMPORTANT: Determine if Electrical or Hydraulic problem exist.

Hydraulic Troubleshooting

CONDITION OF TRIM SYSTEM	PROBLEM
A. Trim motor runs; trim system does not move up or down.	1, 2, 5
B. Does not trim down.	1, 2,
C. Does not trim up.	1, 2
D. Partial or Jerky down/up.	1, 3
E. Thump noise when shifting.	2, 3
F. Does not trim under load.	1, 2,
G. Does not hold trim position under load.	2, 3
H. Trail out when backing off from high speed.	2
I. Leaks down and does not hold trim.	2, 3
J. Trim motor working hard and trims slow up and down.	1, 2, 4
K. Starts to trim up from full down position when IN trim button is depressed.	2
L. Trim position will not hold in reverse.	2, 3

PROBLEM

1. Low oil level.
2. Pump assembly faulty.
3. Tilt ram piston O-ring leaking or cut.
4. Check condition of battery.
5. Broken motor/pump drive shaft.

Electrical Troubleshooting

CONDITION OF TRIM SYSTEM	PROBLEM
A. Trim motor does not run when trim button is depressed.	1, 2, 4, 5, 6, 7, 8
B. Trim system trims opposite of buttons.	3

PROBLEM

1. Battery low or discharged.
2. Open circuit in trim wiring.
3. Wiring reversed in remote control or in panel control.
4. Wire harness corroded through.
5. Internal motor problem (brushes, shorted armature).
6. Blown fuses.
7. Trim switch failure.
8. Verify relays are functioning correctly.

Power Trim Relay Test Procedure

The trim motor relay system used on permanent magnet trim systems, connects each of the two wires from the trim motor to either ground, or positive, in order to allow the motor to run in both directions.

If the motor will not run in the UP direction, it could be either the UP relay is not making contact to 12 volts **OR** the DOWN relay is not making contact to ground. The opposite is true if the system will not run DOWN. When the system is not energized, both relays should connect the heavy motor leads to ground.

To test which relay is faulty if the trim system does not operate in one direction:

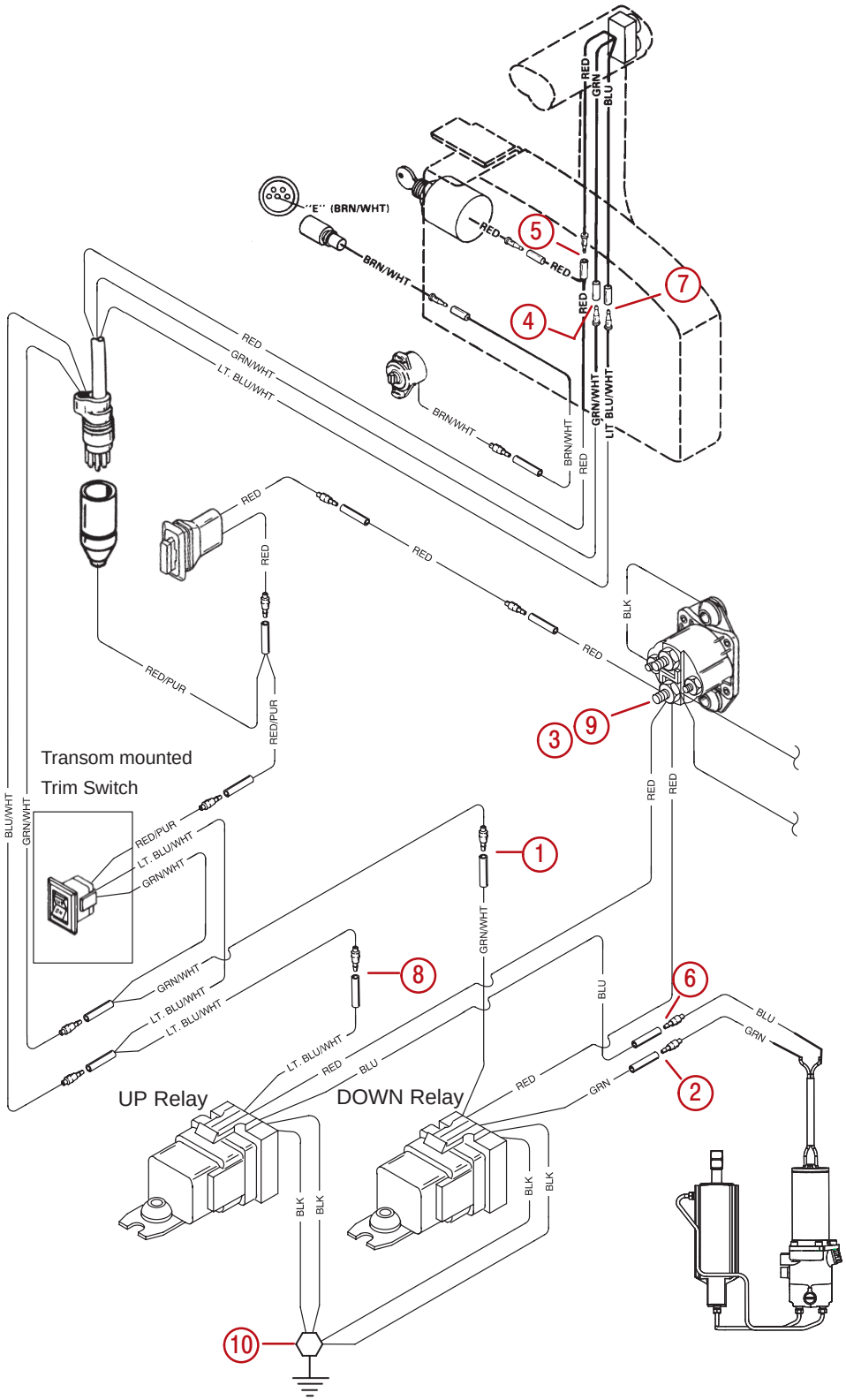
1. Disconnect the heavy gauge pump wires from the trim control relay.
2. Check for continuity between the heavy leads from the trim relays to ground.

Ohmmeter Leads Between	Resistance (Ohms)	Scale Reading (R x 1)
Green and Ground	0	Full Continuity (Rx1)
Blue and Ground	0	Full Continuity (Rx1)

Replace the relay that does not have continuity.

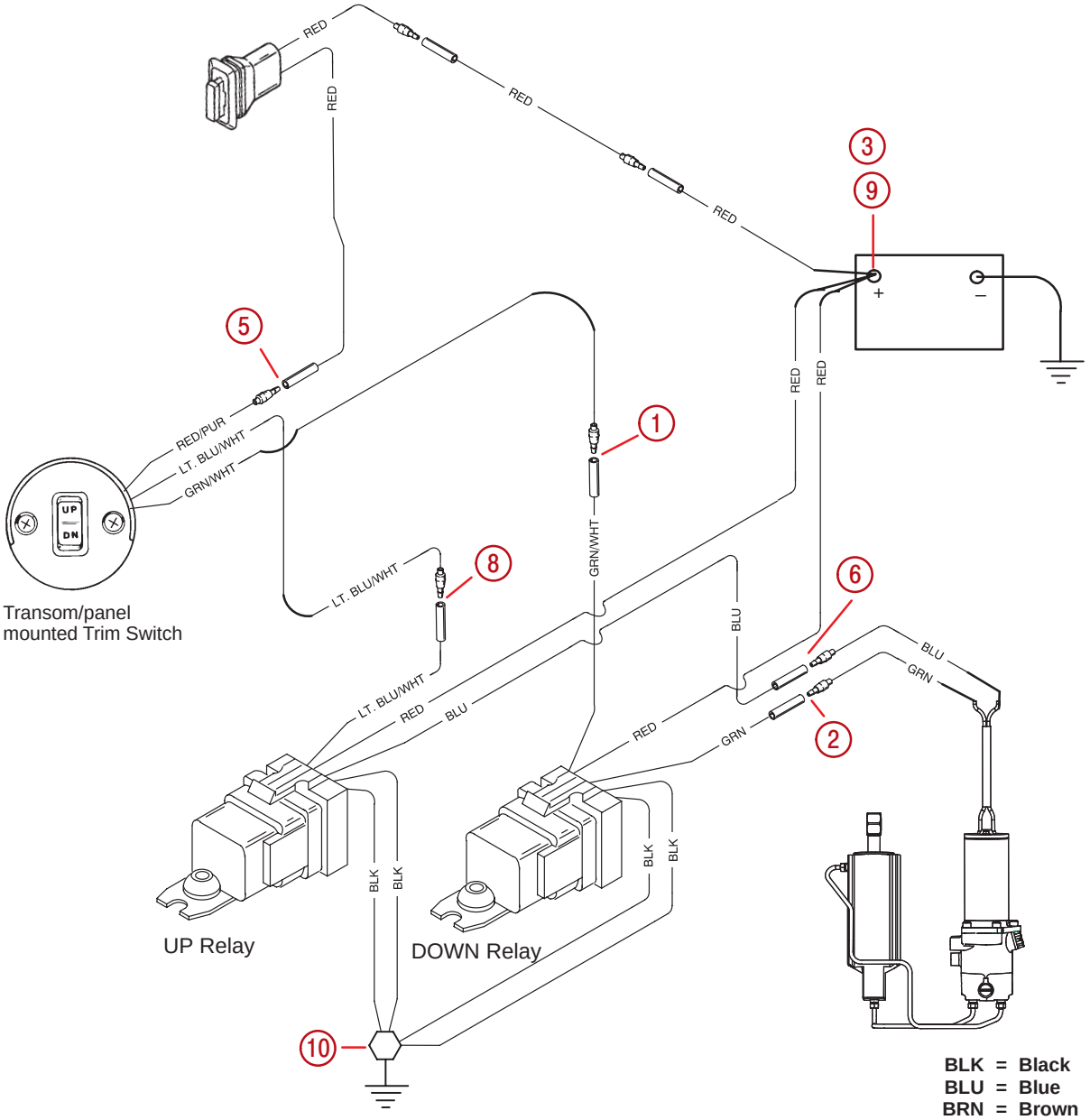
3. Connect a voltmeter to the heavy BLUE lead and to ground. You should have 12 volts on the BLUE lead when the UP switch is pushed. You should should also have 12 volts on the GREEN lead when the DOWN switch is pushed. Replace the relay that does not switch the lead to positive.

Remote Control



BLK = Black
BLU = Blue
BRN = Brown
GRY = Gray
GRN = Green
ORN = Orange
PNK = Pink
PUR = Purple
RED = Red
TAN = Tan
WHT = White
YEL = Yellow
LT = Light
DRK = Dark

Tiller Handle



BLK = Black
BLU = Blue
BRN = Brown
GRY = Gray
GRN = Green
ORN = Orange
PNK = Pink
PUR = Purple
RED = Red
TAN = Tan
WHT = White
YEL = Yellow
LT = Light
DRK = Dark

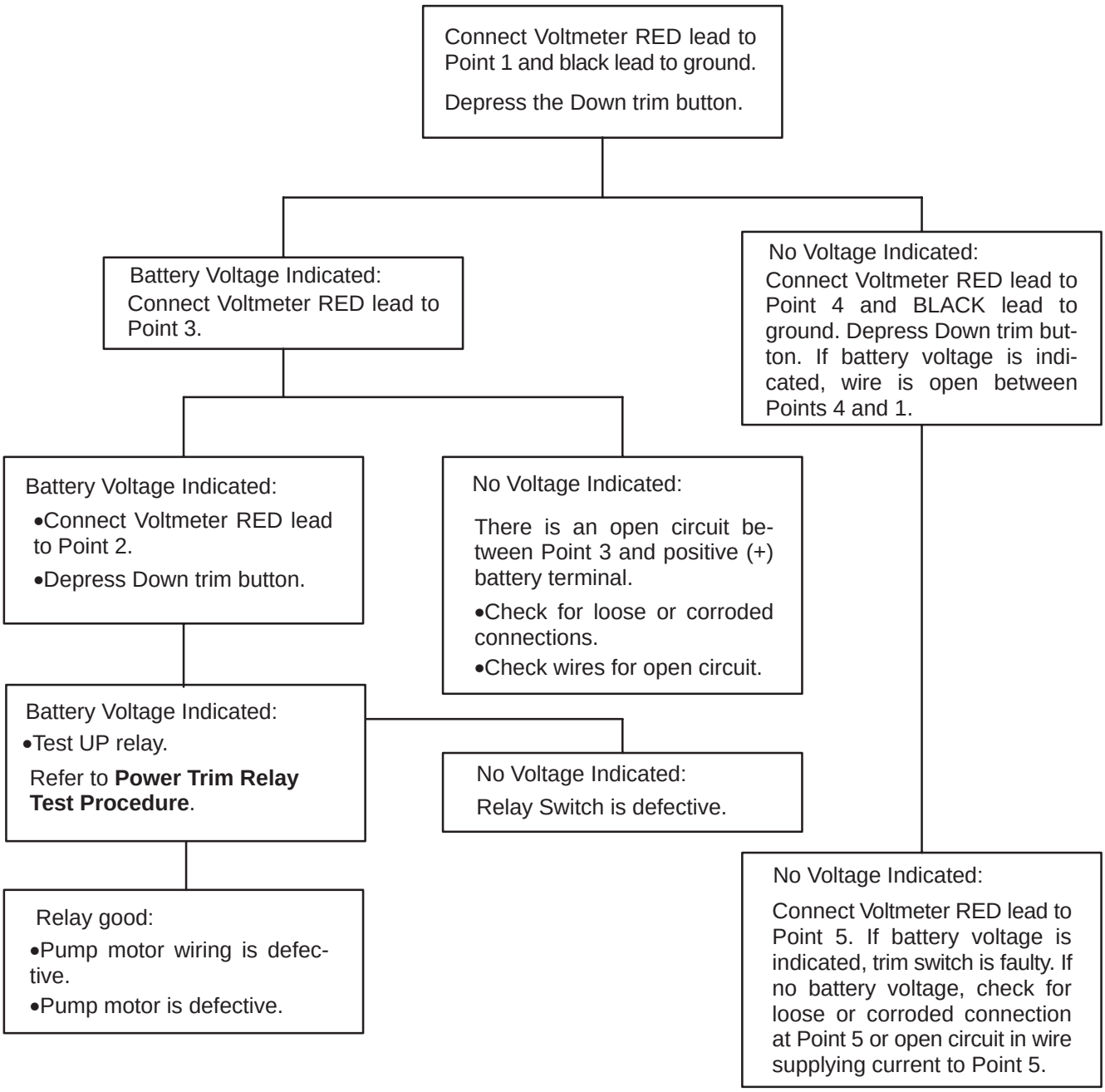
General Checks

Before troubleshooting the Power Trim electrical system, check the following:

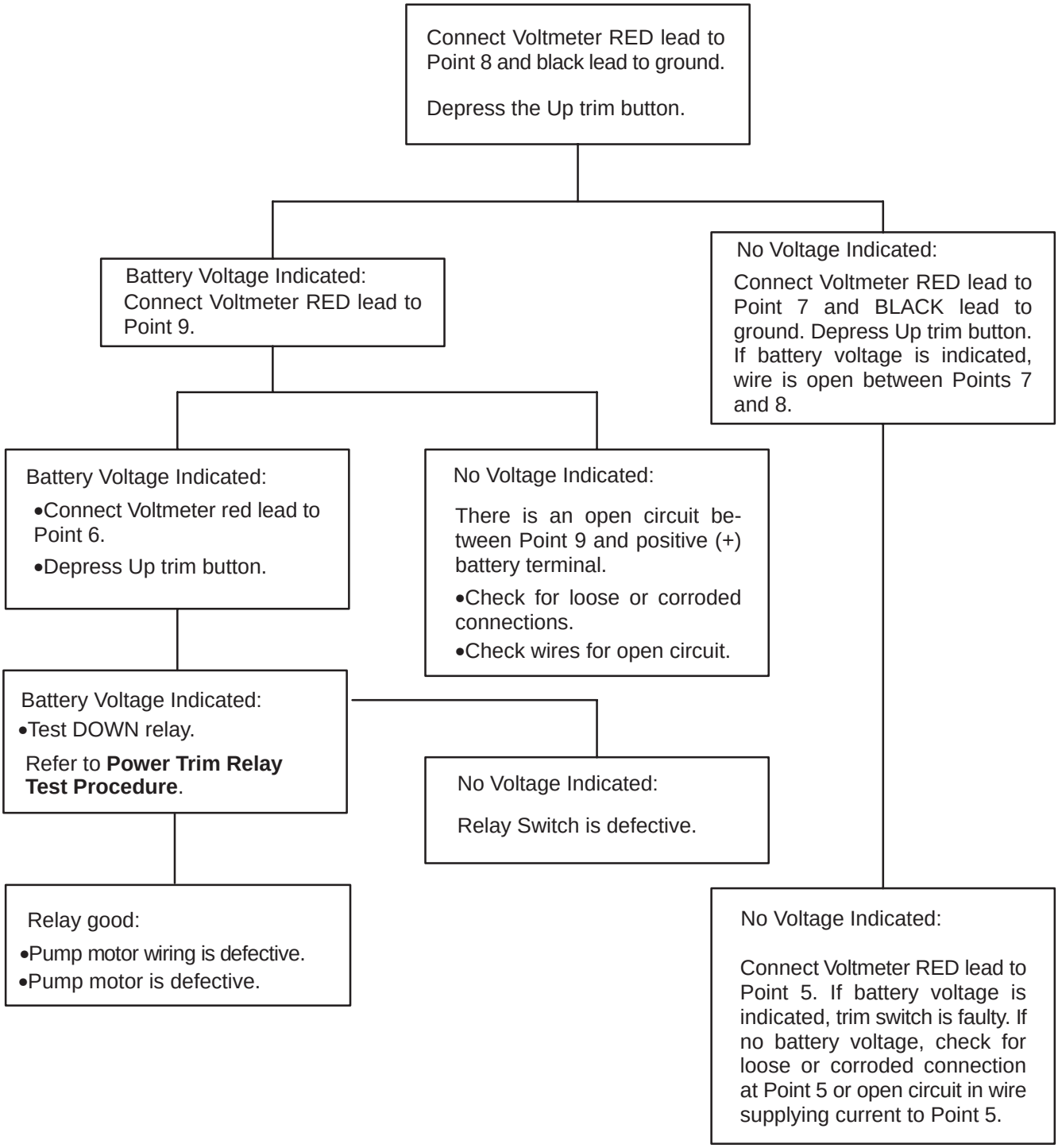
1. Check for disconnected wires.
2. Make certain all connections are tight and corrosion free.
3. Check that plug-in connectors are fully engaged.
4. Make certain battery is fully charged.

Refer to the preceding Remote Control or Tiller Handle wiring diagram for connection points when troubleshooting the electrical system. (Connection points are specified by number.)

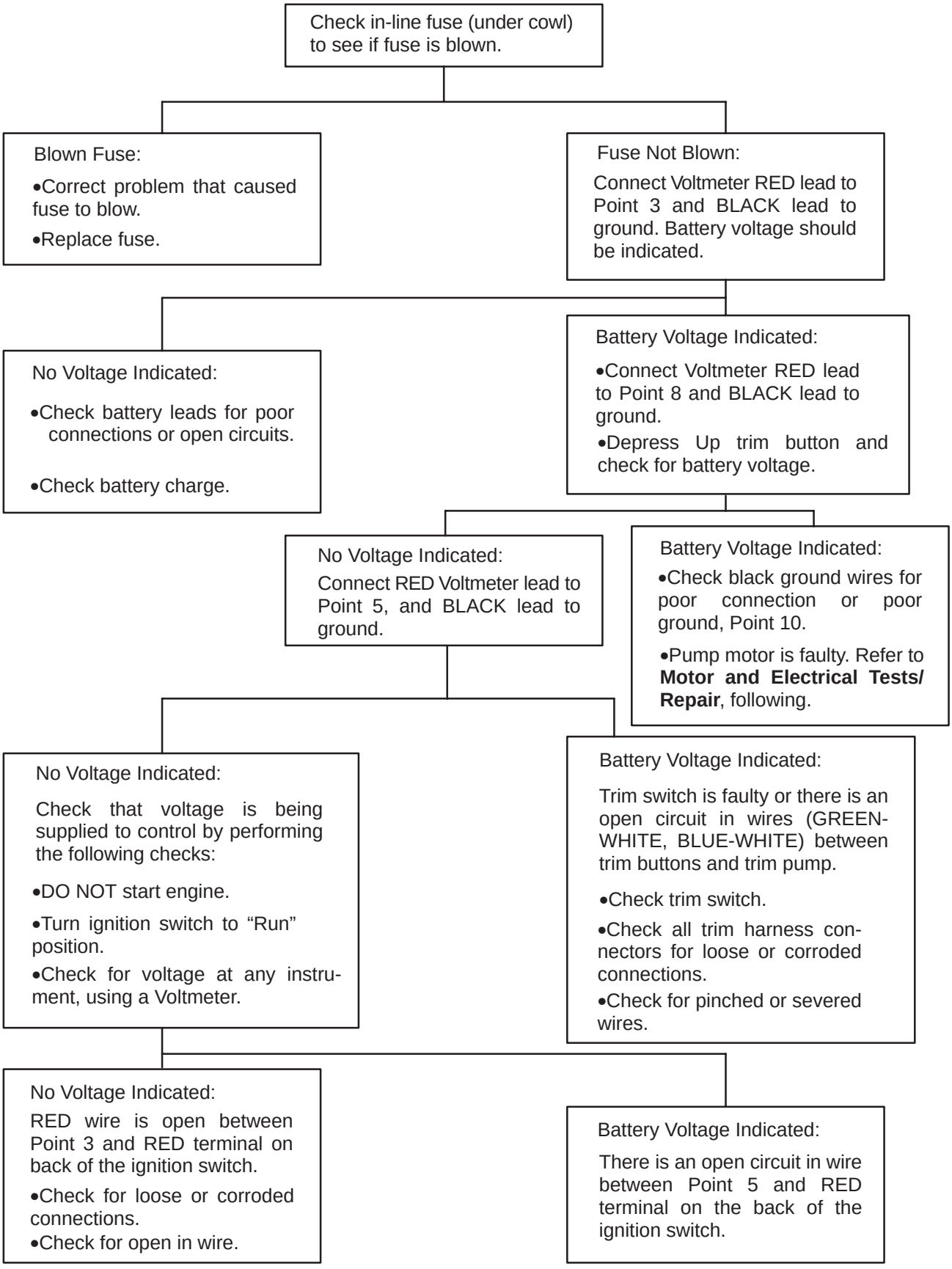
Troubleshooting the Down Circuit


Connect Voltmeter RED lead to Point 1 and black lead to ground.
Depress the Down trim button.
Battery Voltage Indicated:
Connect Voltmeter RED lead to Point 3.
No Voltage Indicated:
Connect Voltmeter RED lead to Point 4 and BLACK lead to ground. Depress Down trim button. If battery voltage is indicated, wire is open between Points 4 and 1.
Battery Voltage Indicated:
•Connect Voltmeter RED lead to Point 2.
•Depress Down trim button.
No Voltage Indicated:
There is an open circuit between Point 3 and positive (+) battery terminal.
•Check for loose or corroded connections.
•Check wires for open circuit.
Battery Voltage Indicated:
•Test UP relay.
Refer to Power Trim Relay Test Procedure.
No Voltage Indicated:
Relay Switch is defective.
Relay good:
•Pump motor wiring is defective.
•Pump motor is defective.
No Voltage Indicated:
Connect Voltmeter RED lead to Point 5. If battery voltage is indicated, trim switch is faulty. If no battery voltage, check for loose or corroded connection at Point 5 or open circuit in wire supplying current to Point 5.

Troubleshooting the Up Circuit


Connect Voltmeter RED lead to Point 8 and black lead to ground.
Depress the Up trim button.
Battery Voltage Indicated: Connect Voltmeter RED lead to Point 9.
No Voltage Indicated: Connect Voltmeter RED lead to Point 7 and BLACK lead to ground. Depress Up trim button. If battery voltage is indicated, wire is open between Points 7 and 8.
Battery Voltage Indicated: •Connect Voltmeter red lead to Point 6. •Depress Up trim button.
No Voltage Indicated: There is an open circuit between Point 9 and positive (+) battery terminal. •Check for loose or corroded connections. •Check wires for open circuit.
Battery Voltage Indicated: •Test DOWN relay. Refer to Power Trim Relay Test Procedure.
No Voltage Indicated: Relay Switch is defective.
Relay good: •Pump motor wiring is defective. •Pump motor is defective.
No Voltage Indicated: Connect Voltmeter RED lead to Point 5. If battery voltage is indicated, trim switch is faulty. If no battery voltage, check for loose or corroded connection at Point 5 or open circuit in wire supplying current to Point 5.

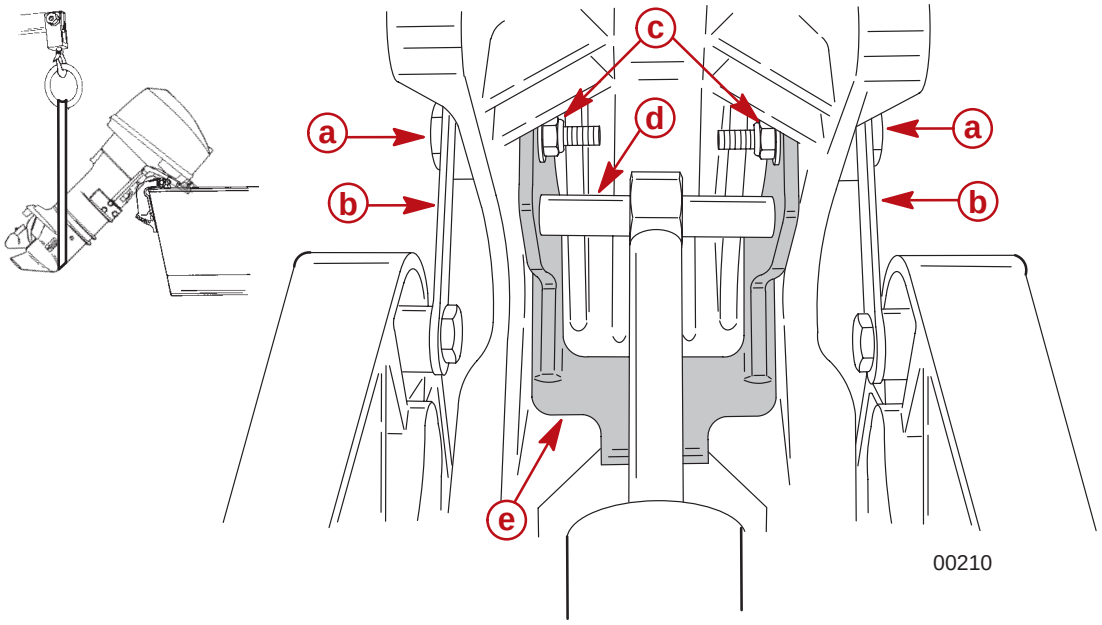
Troubleshooting the Down and Up Circuits (All Circuits Inoperative)


Check in-line fuse (under cowl) to see if fuse is blown.
Blown Fuse:
•Correct problem that caused fuse to blow.
•Replace fuse.
Fuse Not Blown:
Connect Voltmeter RED lead to Point 3 and BLACK lead to ground. Battery voltage should be indicated.
No Voltage Indicated:
•Check battery leads for poor connections or open circuits.
•Check battery charge.
Battery Voltage Indicated:
•Connect Voltmeter RED lead to Point 8 and BLACK lead to ground.
•Depress Up trim button and check for battery voltage.
No Voltage Indicated:
Connect RED Voltmeter lead to Point 5, and BLACK lead to ground.
Battery Voltage Indicated:
•Check black ground wires for poor connection or poor ground, Point 10.
•Pump motor is faulty. Refer to Motor and Electrical Tests/ Repair, following.
No Voltage Indicated:
Check that voltage is being supplied to control by performing the following checks:
•DO NOT start engine.
•Turn ignition switch to “Run” position.
•Check for voltage at any instrument, using a Voltmeter.
Battery Voltage Indicated:
Trim switch is faulty or there is an open circuit in wires (GREEN-WHITE, BLUE-WHITE) between trim buttons and trim pump.
•Check trim switch.
•Check all trim harness connectors for loose or corroded connections.
•Check for pinched or severed wires.
No Voltage Indicated:
RED wire is open between Point 3 and RED terminal on back of the ignition switch.
•Check for loose or corroded connections.
•Check for open in wire.
Battery Voltage Indicated:
There is an open circuit in wire between Point 5 and RED terminal on the back of the ignition switch.

Power Trim

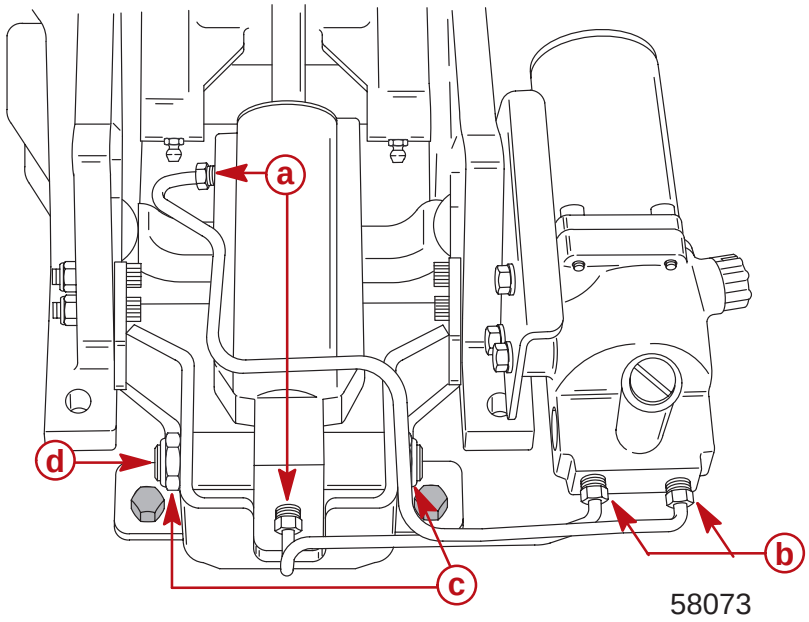
Cylinder Removal

1. Support outboard in a trimmed up position.
2. Remove the tilt stop strap retaining bolts/nuts.
3. Remove the upper bracket.
4. Remover the upper pivot pin from the bracket.



a - Tilt stop strap retaining bolt
b - Tilt stop strap
c - Upper bracket nut
d - Upper pivot pin
e - Upper bracket

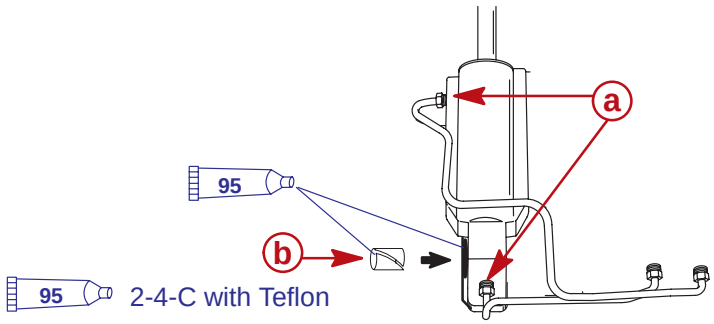
5. Loosen the cylinder hydraulic lines. Do not remove.
6. Remove the hydraulic lines from the pump assembly.
7. Remove the cylinder lower pivot pin nuts.
8. Remove the pivot pin.
9. Remove the hydraulic lines from the cylinder .



a - Cylinder hydraulic lines
b - Pump hydraulic lines
c - Lower pivot pin nut (2)
d - Lower pivot pin

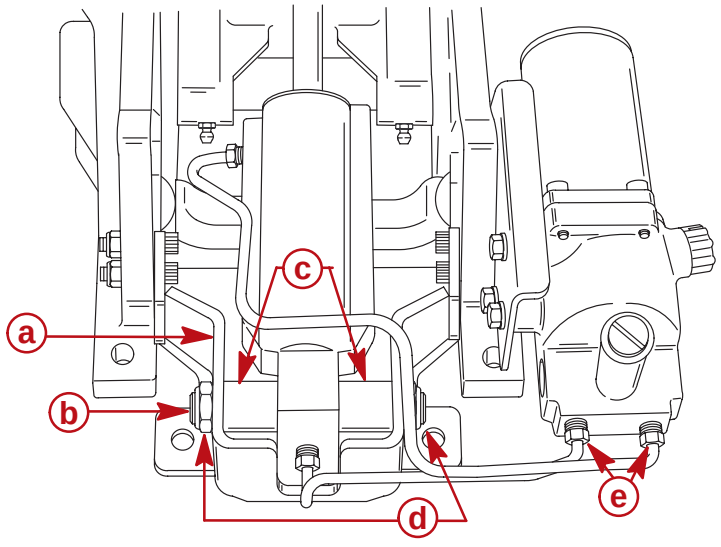
Cylinder Assembly/Installation

1. Install the hydraulic lines to cylinder. DO NOT TIGHTEN.
2. Insert the nylon bushing into the cylinder lower pivot bore.
3. Lubricate cylinder lower pivot bore with 2-4-C with Teflon.



a - Hydraulic line (2)
b - Nylon bushing

4. Insert the lower pivot pin into the support bracket.
5. Install the spacer.
6. Align the cylinder with the lower pivot pin. Push the pivot pin through the tilt cylinder so it is flush with cylinder.
7. Insert the remaining spacer and push pivot pin through.
8. Install pivot nuts. Tighten to the specified torque.
9. Install hydraulic lines to hydraulic pump finger tight. Be careful not to cross thread the hydraulic line flare nuts in the pump body.
10. Tighten all Hydraulic lines.

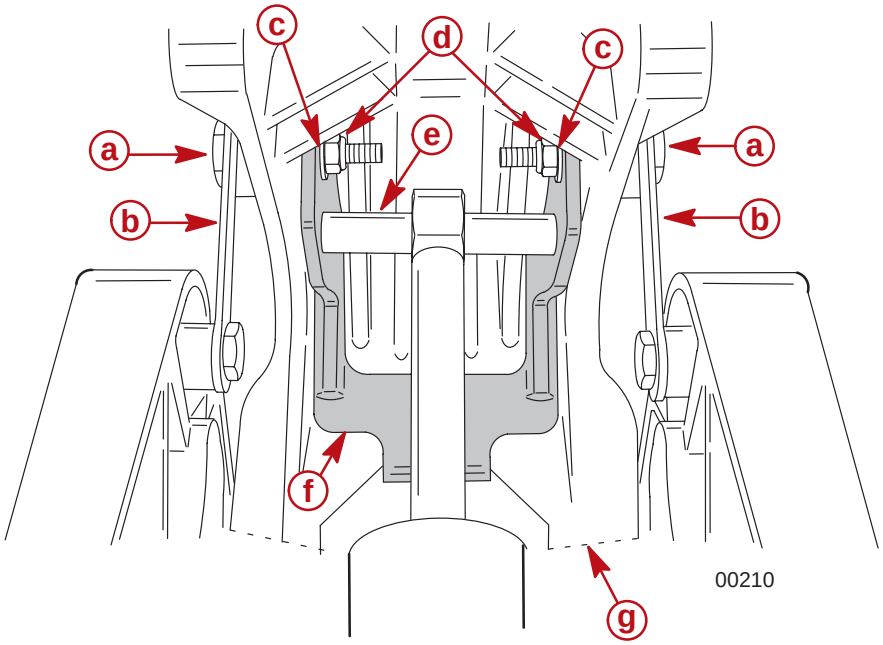


58073

a - Support bracket
b - Pivot pin
c - Spacer (2)
d - Pivot nut (2)
e - Hydraulic line flare nut

Lower Pivot Pin Nut Torque
13.6 Nm (120 lb-in.)

11. Install the upper pivot pin into the upper bracket.
12. Guide the upper pivot through the trim cylinder rod eye and through the upper bracket.
13. Install the upper bracket to the swivel bracket.
14. Secure the bracket with 2 shoulder bolts inserted through the tilt stop brackets.
15. Install a washer and nylock nut on shoulder bolt. Tighten to specified torque.



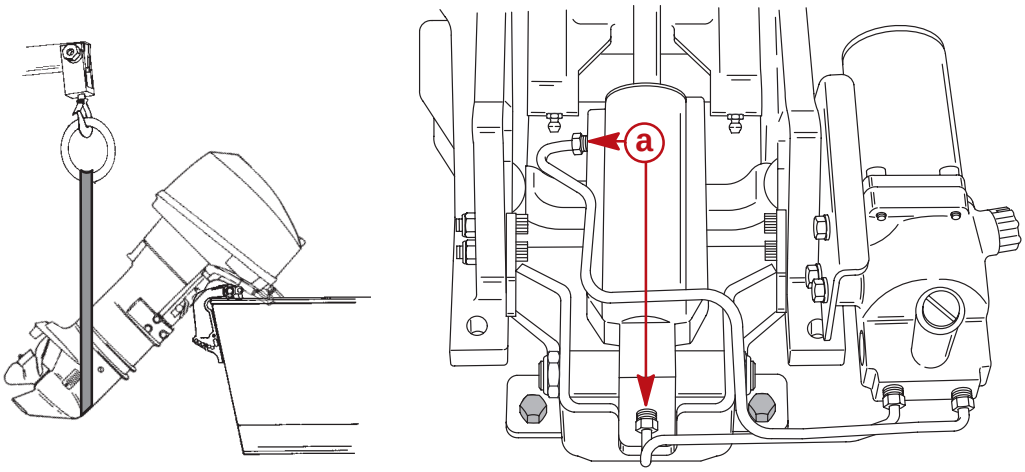
a - Tilt stop strap retaining bolt (2)
b - Tilt stop strap (2)
c - Washer (2)
d - Upper bracket nut (2)
e - Upper pivot pin
f - Upper bracket
g - Swivel bracket

Tilt Stop Strap Retaining Bolt Torque
16.3 Nm (144 lb-in.)

Hydraulic Pump

Removal

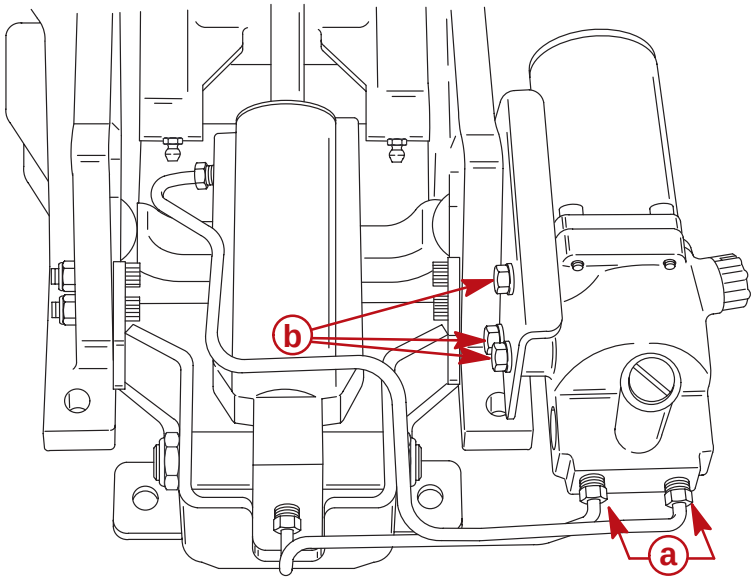
1. Support the outboard in a trimmed up position.
2. Loosen the hydraulic lines at the cylinder. (Do not remove hydraulic lines from cylinder).



58073

a - Cylinder hydraulic lines

3. Disconnect the trim motor wires from the solenoid harness. (Refer to the Remote Control and Tiller Handle Wiring Diagrams in this section.)
4. Remove the hydraulic lines from the hydraulic pump.
5. Remove the 3 screws holding the hydraulic pump to the support bracket.

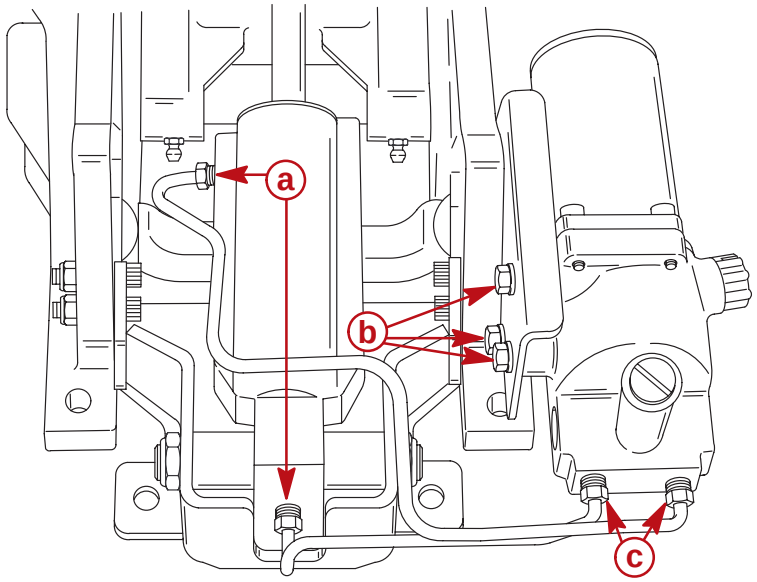


58073

a - Hydraulic lines
b - Hydraulic pump screws (3)

Installation

1. Install hydraulic pump to support bracket with 3 screws. Do not tighten.
2. Install hydraulic lines to hydraulic pump finger tight. Be careful not to cross thread the hydraulic line flare nut in the pump body.
3. Tighten the hydraulic pump mounting screws to the specified torque.
4. Tighten the hydraulic lines at the pump and cylinder.
5. Connect the motor wires to the solenoid harness.



58073

a - Cylinder hydraulic lines
b - Hydraulic pump mounting screw (3)
c - Hydraulic pump lines

Hydraulic Pump Mounting Screw Torque
9 Nm (80 lb-in.)

Filling Hydraulic Reservoir

1. Open the manual release valve 3 turns.
2. Fill the reservoir the with Power Trim and Steering Fluid. Install the fill cap.
3. Manually raise and lower the trim several times.
4. Check the level of the fluid in the reservoir. Fill as needed. Install the fill cap.
5. Manually raise and lower the trim several times as needed.
6. Tighten the manual release valve.
7. Cycle the trim 3 times electrically. Check for proper operation and fluid level in reservoir.

LOWER UNIT

Section 6 – Gear Housing

Table of Contents

Specifications 6-1
Special Tools 6-2
Gear Housing (Drive Shaft) (2.00:1 Gear Ratio) 6-4
Gear Housing (Propeller Shaft) (2.00:1 Gear Ratio) 6-7
Gearcase Removal 6-8
Gearcase Disassembly 6-9
Propeller Removal 6-9
Draining and Inspecting Gear Lubricant . 6-9
Bearing Carrier 6-10
Propeller Shaft 6-12
Water Pump, Drive Shaft and Shift Shaft 6-13
Pinion Gear and Forward Gear 6-17
Drive Shaft Bushing, Bearing and Lubrication Sleeve 6-20
Aluminum Anode and Water Inlet 6-22
Reassembly 6-22
Drive Shaft Needle Bearing, Bushing and Lubrication Sleeve Installation 6-22
Forward Gear Bearing Race Installation . 6-24
Forward Gear Reassembly 6-24
Bearing Carrier Reassembly 6-25
Water Pump Base and Shift Shaft Reassembly 6-26
Propeller Shaft Reassembly 6-27
Forward Gear, Pinion Gear and Drive Shaft Installation 6-28
Shift Shaft and Water Pump Base Installation 6-29
Water Pump Cover Reassembly 6-30
Impeller and Pump Cover Installation . . . 6-31
Propeller Shaft and Bearing Carrier Installation 6-32
Installation 6-33
Propeller Installation 6-37
Filling Gear Housing with Lubricant 6-38

6

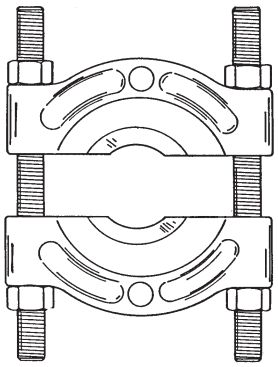
Specifications

GEAR HOUSING	**Gear Ratio**	2.0:1
	Gearcase Capacity	200 ml (6.8 fl. oz.)
	Lubricant Type	Premium Blend Gear Lubricant
	Forward Gear - No. of Teeth-Type	26 Spiral/Bevel
	Pinion Gear - No. of Teeth-Type	13 Spiral/Bevel
	Pinion Height	Floating
	Forward Gear Backlash	No Adjustment
	Reverse Gear Backlash	No Adjustment
	Water Pressure	
	With Thermostat	
	– @ W.O.T (5000 RPM)	(5 – 7 PSI)
	– @ Idle	3.4 - 10.3 kPa (.5 – 1.5 PSI)
	Without Thermostat	
	– @ W.O.T (5000 RPM	34.5 - 48.3 kPa (5 – 7 PSI)
	– @ Idle (750 RPM)	0 - 6.9 kPa (0 – 1 PSI)

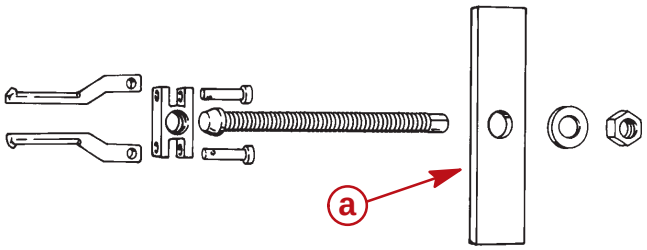
NOTE: *Tell-tale at IDLE may be intermittant on engines with thermostats installed.*

Special Tools

1. Universal Puller Plate 91-37241

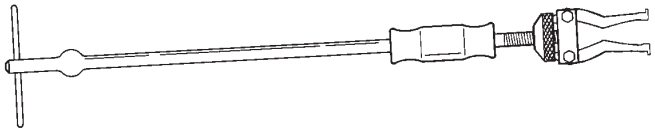


2. Puller Assembly 91-83165T and Puller Plate 91-29310

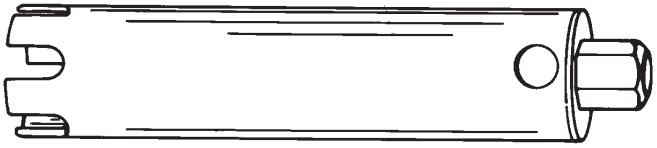


a - Puller Plate 91-29310

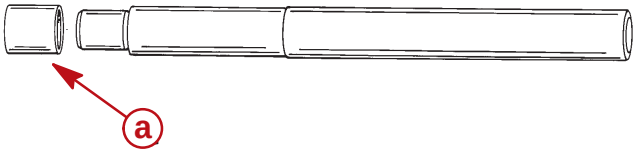
3. Slide Hammer 91-34569A1



4. Bearing Carrier Tool 91-13664

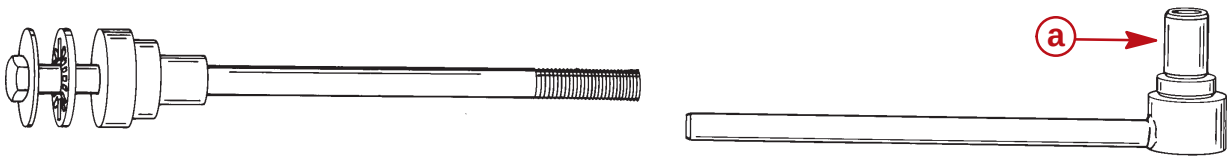


5. Drive Shaft Bearing Removal Tool 91-824788A1



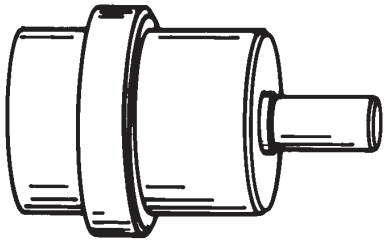
a - Drive Shaft Bushing Removal Tool 23-824789

6. Drive Shaft Bushing Installation Tool 91-824790A1

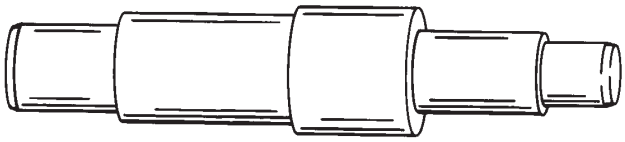


a - Drive Shaft Bearing Installation Tool 91-824791

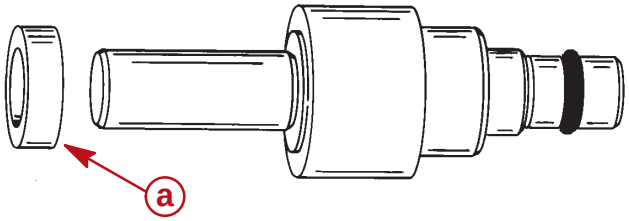
7. Mandrel 91-13658T



8. Bushing Removal Tool 91-824787

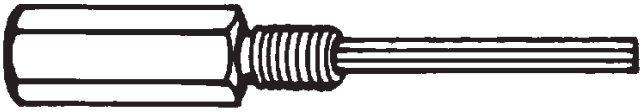


9. Seal Installation Tool 91-824785T1



a - Seal/Bushing Installation Tool 23-824786

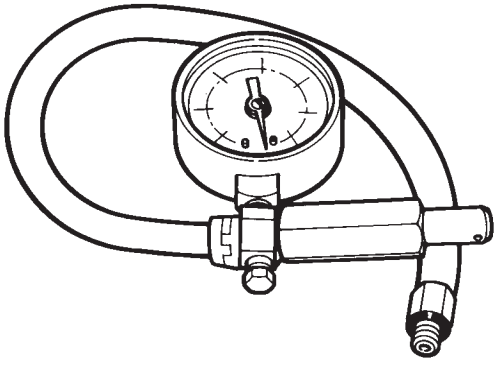
10. Expanding Rod (SNAP ON P/N CG40-4)*



11. Collet (Jaws) (SNAP ON P/N CG40-15)*



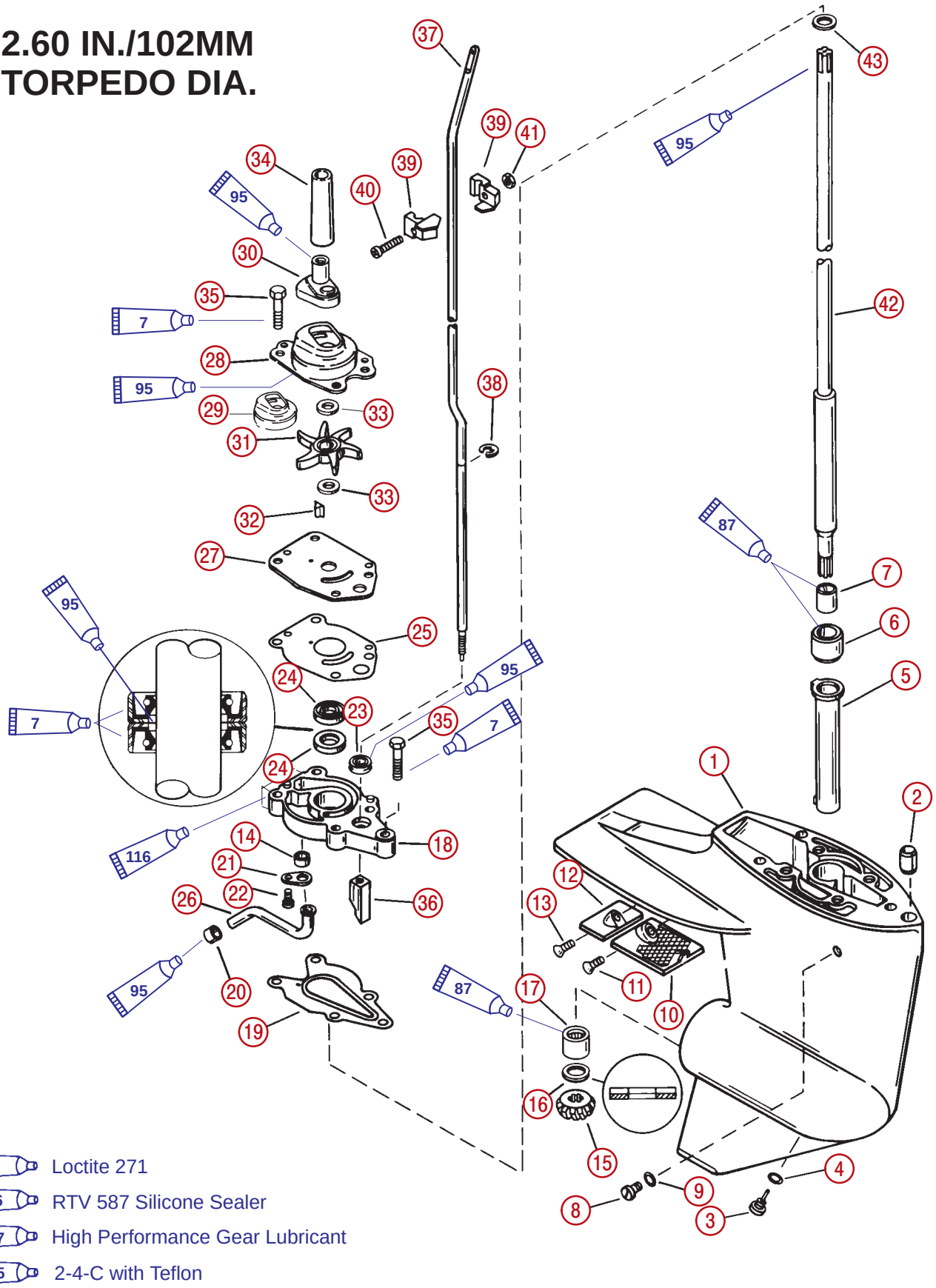
12. Leakage Tester FT8950



*Purchase From: SNAP ON TOOLS Corporation
2801 - 80th Street
Kenosha, Wi. 53141-1410

Gear Housing (Drive Shaft) (2.00:1 Gear Ratio)

2.60 IN./102MM TORPEDO DIA.



7 Loctite 271

116 RTV 587 Silicone Sealer

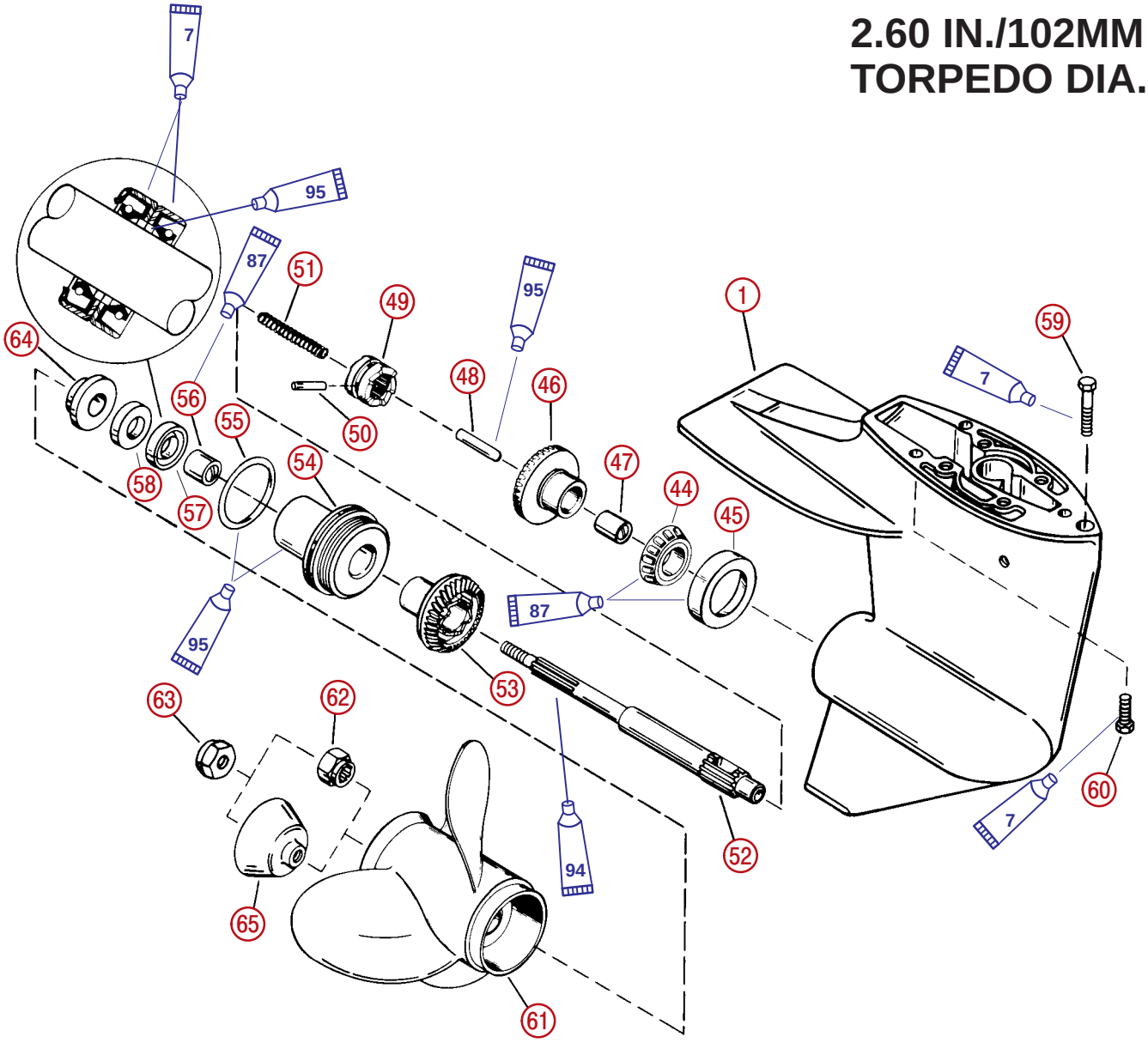
87 High Performance Gear Lubricant

95 2-4-C with Teflon

Gear Housing (Drive Shaft) (2.00:1 Gear Ratio) (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
–	1	GEAR HOUSING **(BLACK-SHORT)**			
–	1	GEAR HOUSING **(BLACK-LONG)**			
1	1	GEAR HOUSING **(BLACK-BASIC)**			
2	1	BUSHING–gear housing			
3	1	DRAIN SCREW			
4	1	SEALING WASHER			
5	1	SLEEVE ASSEMBLY			
6	1	SLEEVE			
7	1	BUSHING			
8	1	SCREW PLUG KIT			
9	1	SEALING WASHER			
10	1	SCREEN			
11	1	SCREW	30		3.4
12	1	ANODE ASSEMBLY			
13	1	SCREW	30		3.4
14	1	SEAL			
15	1	PINION GEAR (13 TEETH)			
16	1	WASHER–thrust			
17	1	BEARING			
18	1	WATER PUMP BASE			
19	1	GASKET			
20	1	SEAL			
21	1	RETAINER			
22	1	SCREW (10-16 x 1/2)	Drive Tight		
23	1	QUAD RING			
24	2	OIL SEAL			
25	1	GASKET			
26	1	WATER TUBE			
27	1	FACE PLATE			
28	1	COVER ASSEMBLY			
29	1	INSERT			
30	1	SEAL			
31	1	IMPELLER			
32	1	KEY ASSEMBLY			
33	2	WASHER			
34	1	GUIDE			
35	5	SCREW–water pump (M6 x 30)	50		5.6
36	1	CAM–shift			
37	1	SHIFT SHAFT **(SHORT)**			
	1	SHIFT SHAFT **(LONG)**			
38	1	E-RING			
39	2	GUIDE			
40	1	SCREW (M5 x 25)	45		5.1
41	1	NUT–guide screw	45		5.1
42	1	DRIVE SHAFT **(SHORT)**			
	1	DRIVE SHAFT **(LONG)**			
43	1	THRUST WASHER			

Gear Housing (Propeller Shaft) (2.00:1 Gear Ratio)



7 Loctite 271

87 High Performance Gear Lubricant

94 Anti-Corrosion Grease

95 2-4-C with Teflon

Gear Housing (Propeller Shaft) (2.00:1 Gear Ratio) (continued)

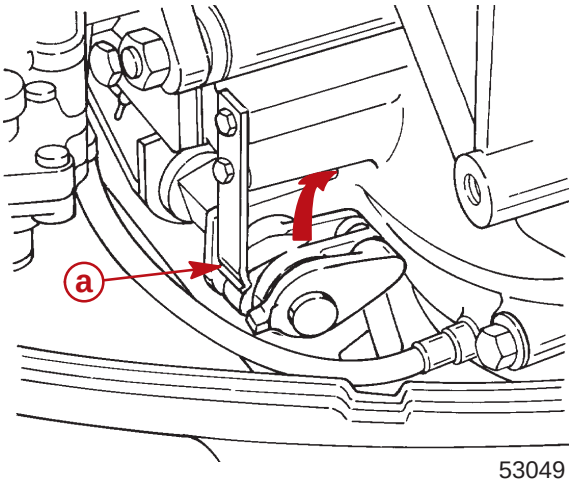
REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
–	1	GEAR HOUSING **(BLACK-SHORT)**			
–	1	GEAR HOUSING **(BLACK-LONG)**			
1	1	GEAR HOUSING **(BLACK-BASIC)**			
44	1	ROLLER BEARING			
45	1	CUP			
46	1	FORWARD GEAR (26 TEETH)			
47	1	BUSHING			
48	1	CAM FOLLOWER			
49	1	CLUTCH ASSEMBLY			
50	1	CROSS PIN			
51	1	SPRING			
52	1	PROPELLER SHAFT			
53	1	REVERSE GEAR (26 TEETH)			
54	1	BEARING CARRIER		85	115.2
55	1	O-RING			
56	1	BUSHING			
57	1	OIL SEAL			
58	1	OIL SEAL			
59	1	SCREW (M8 x 50)	180		20.3
60	2	SCREW (M8 x 30)	180		20.3
61	1	PROPELLER **(9-1/4 IN. x 7 IN.)**			
	1	PROPELLER **(9 IN. x 9 IN.)**			
	1	PROPELLER **(9-3/4 IN. x 6-1/2 IN.)**			
62	1	SPACER			
63	1	PROPELLER NUT	100		11.3
64	1	THRUST HUB			
65	1	HI-REVERSE THRUST CUP			

Gearcase Removal

⚠ WARNING

To prevent accidental engine starting, remove (and isolate) spark plug leads from spark plugs BEFORE removing gear housing.

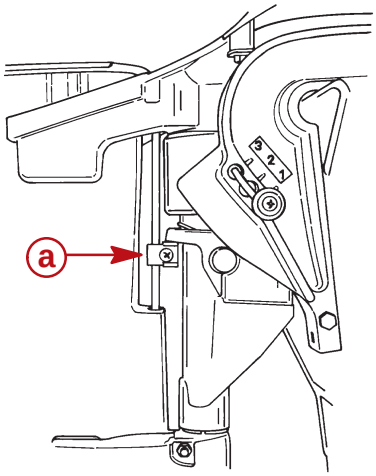
1. Remove and isolate spark plug leads from spark plugs.
2. Shift outboard into FORWARD gear.
3. Tilt outboard to full UP position.
4. Remove shift shaft retainer.



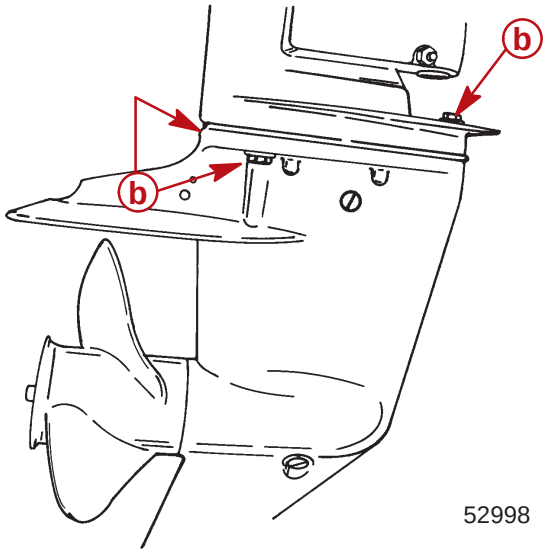
53049

a - Retainer

5. Remove reverse lock actuator.
6. Remove 3 bolts.



53004



52998

a - Actuator
b - Bolts (3)

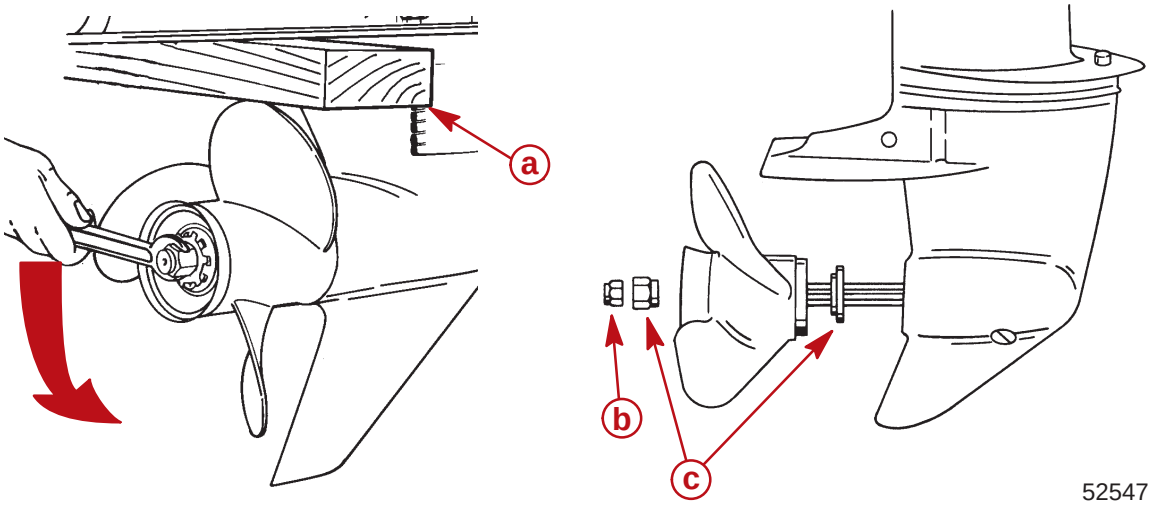
Gearcase Disassembly

Propeller Removal

⚠ WARNING

If gear housing is NOT removed from drive shaft housing, remove and isolate spark plug leads from spark plugs to prevent outboard from accidentally starting while removing and installing propeller.

1. Place a block of wood between anti-ventilation plate and propeller to prevent propeller from turning and to protect hands while removing prop.
2. Remove nut, thrust hubs and propeller.



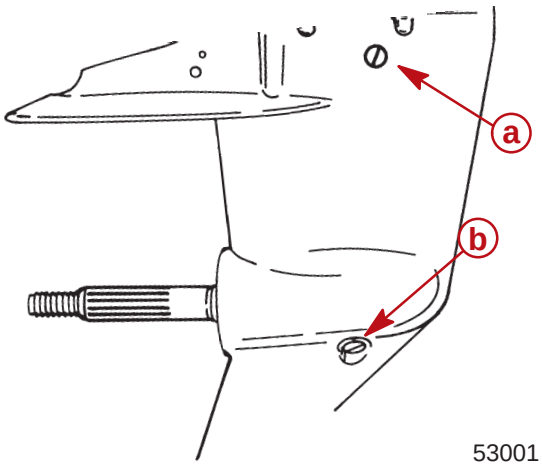
a - Wood
b - Nut
c - Thrust hub

Draining and Inspecting Gear Lubricant

1. Remove both VENT and FILL screws with gaskets.
2. Inspect gear lubricant for metal particles. Presence of a small amount of fine metal particles (resembling powder) indicates normal wear. Presence of large particles (chips) or a large quantity of fine particles indicates need for gear housing disassembly and component inspection.
3. Note color of gear lubricant. White or cream color indicates presence of water in lubricant.

NOTE: *When draining gearcase for the first time, lubricant may appear cream colored due to the mixing of assembly lubricant and gear lubricant. This is NOT an indication of water intrusion. If, during subsequent draining of gearcase, lubricant appears cream colored or milky, water may be present, gearcase should be disassembled and all gaskets, seals and O-rings replaced. Inspect all components for water damage.*

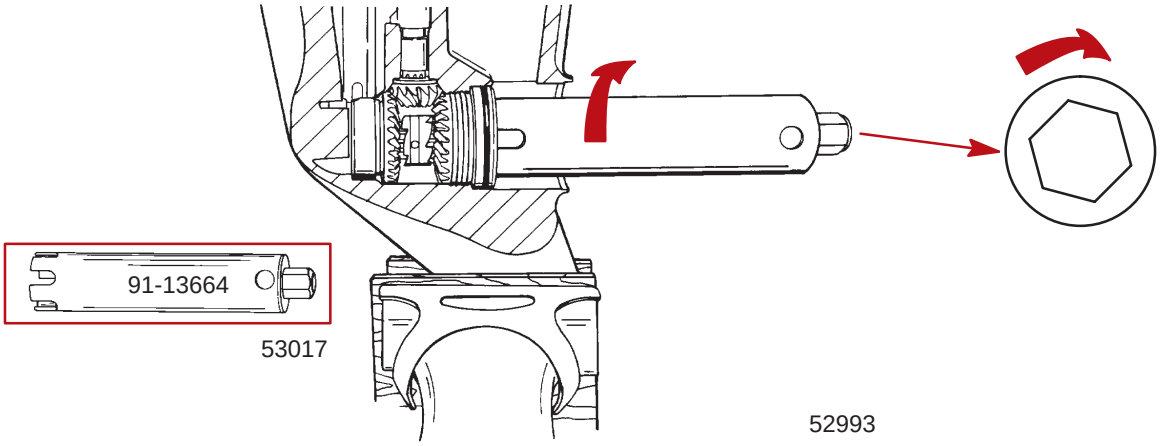
4. Check drain pan for water separation from lubricant. Presence of water in gear lubricant indicates the need for disassembly and inspection of oil seals, seal surfaces and gear housing components.



a - Vent screw
b - Fill screw

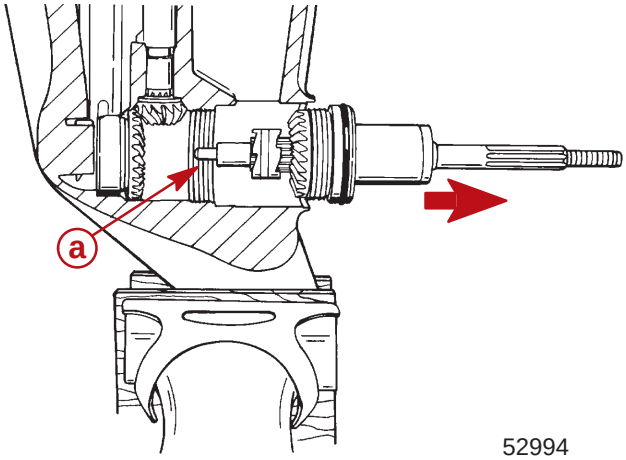
Bearing Carrier

1. Remove bearing carrier (LEFT HAND thread) using Bearing Carrier Tool.



2. Remove carrier and propeller shaft assembly from housing.

NOTE: *Cam follower is free to slide out of propeller shaft.*

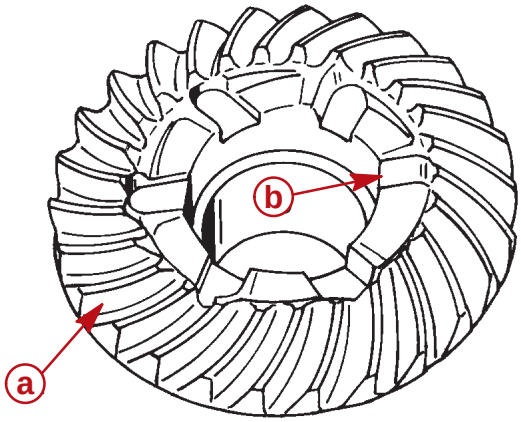


a - Cam follower

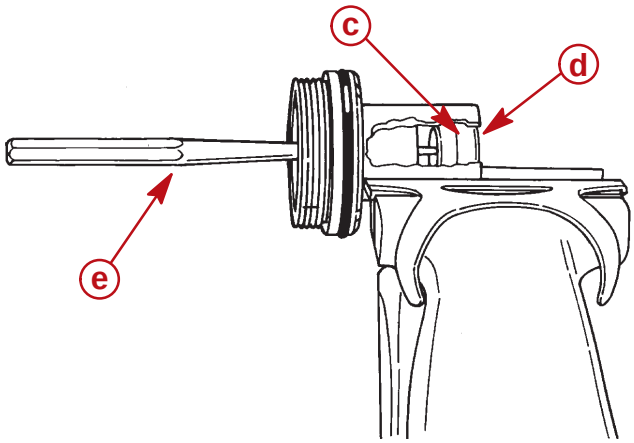
3. Remove propeller shaft and REVERSE gear from bearing carrier.
4. Replace REVERSE gear if gear teeth or clutch teeth are chipped or worn.

NOTE: *When using a punch to remove carrier seals, be careful to not to scar carrier seal surface with punch. If carrier seal surface is damaged, replace carrier.*

5. Using a suitable punch, remove both seals from bearing carrier.



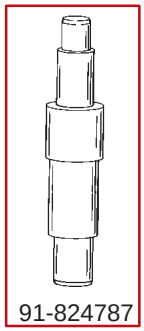
52988



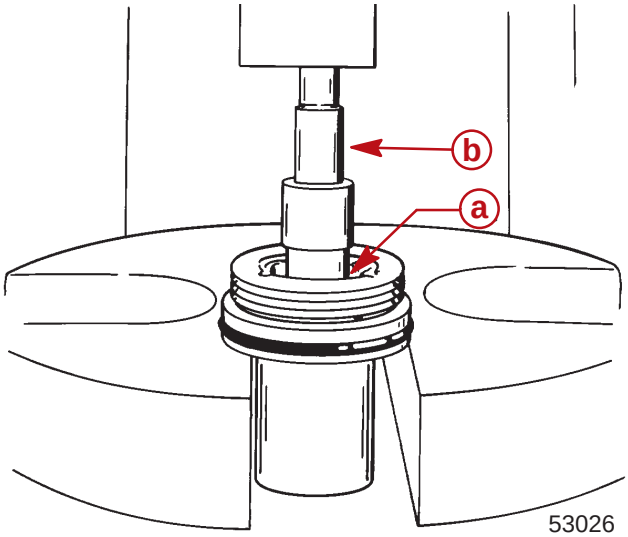
53002

a - Gear teeth
b - Clutch teeth
c - Oil seal
d - Fish line cutter seal
e - Punch

6. Replace bearing carrier bushing if bushing or area on propeller shaft that bushing contacts is pitted or worn. Press bushing from carrier using Bushing Removal Tool.



91-824787
53020

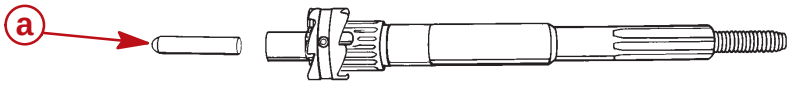


53026

a - Bushing
b - Bushing Removal Tool (91-824787)

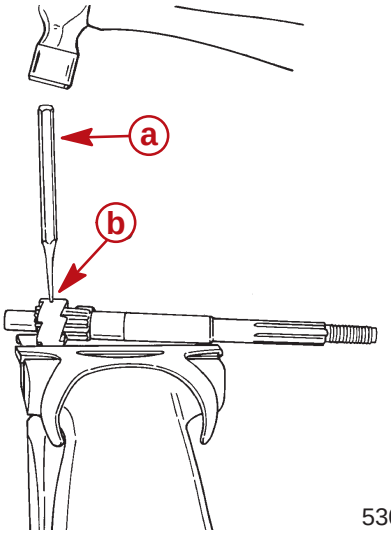
Propeller Shaft

1. Inspect cam follower for wear. If cam follower is worn, replace follower and inspect shift cam for serviceability. Replace cam if worn.



a - Cam follower

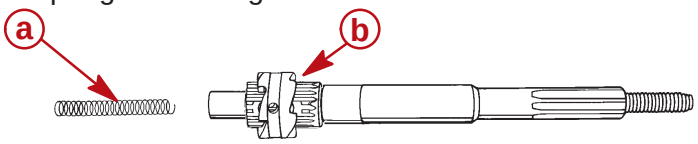
2. Remove groove pin from clutch/propeller shaft applying pressure to side of pin that is NOT grooved. Discard pin.



53013

a - Punch
b - Groove pin (discard)

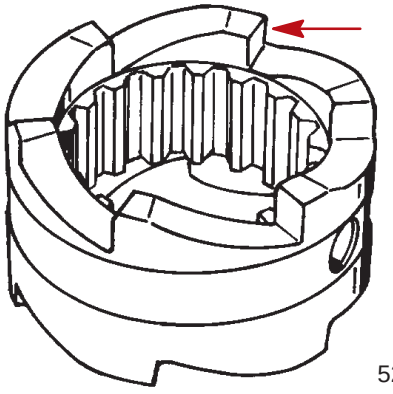
3. Remove spring and sliding clutch.



53005

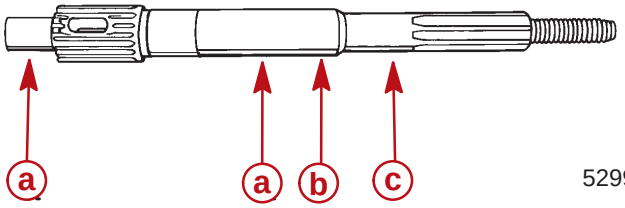
a - Spring
b - Clutch

4. Replace clutch if jaws are rounded or chipped. Rounded jaws may be caused by the following:
   a. Improper shift cable adjustment.
   b. Engine idle speed too high while shifting.
   c. Shifting too slowly from NEUTRAL into FORWARD or REVERSE.



52990

5. Inspect bushing surfaces of propeller shaft for pitting or wear. Replace shaft and corresponding bushing if wear or pitting is observed.
6. Replace shaft if any of the following exist:
   a. Splines are twisted or worn.
   b. Oil seal surface is grooved.
   c. Shaft has a noticeable wobble or is bent more than 0.15mm (.006 in.).



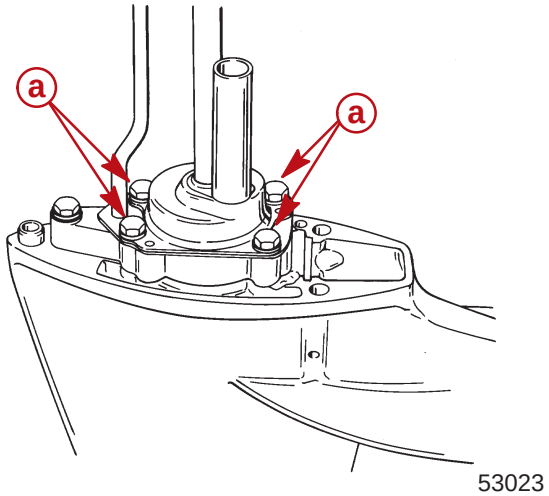
52997

a - Bushing surfaces
b - Oil seal surface
c - Measure here for wobble (When measuring shaft for wobble, use v-blocks and support at bushing surface)

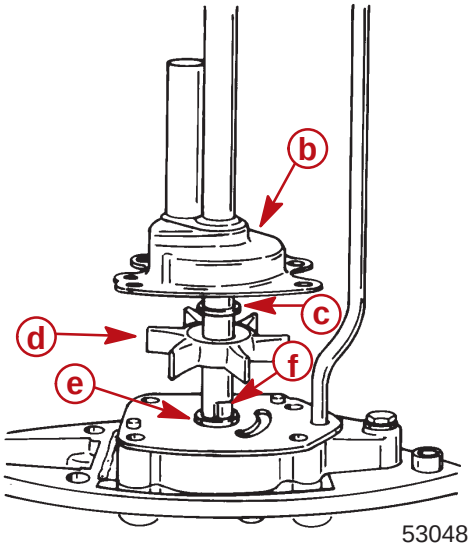
Water Pump, Drive Shaft and Shift Shaft

1. Remove 4 bolts from pump cover.
2. Remove cover, nylon washers above and below impeller, impeller and drive key from drive shaft.
3. It is recommended that impeller be replaced whenever gearcase is being serviced.

NOTE: *If impeller is not going to be replaced, DO NOT install impeller in reverse rotation to its original state as vanes have taken a set. Vanes will crack and break shortly after outboard is returned to service.*



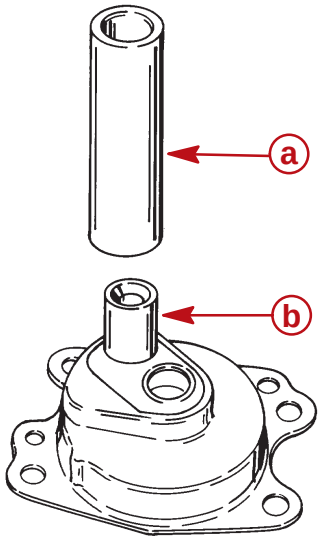
53023



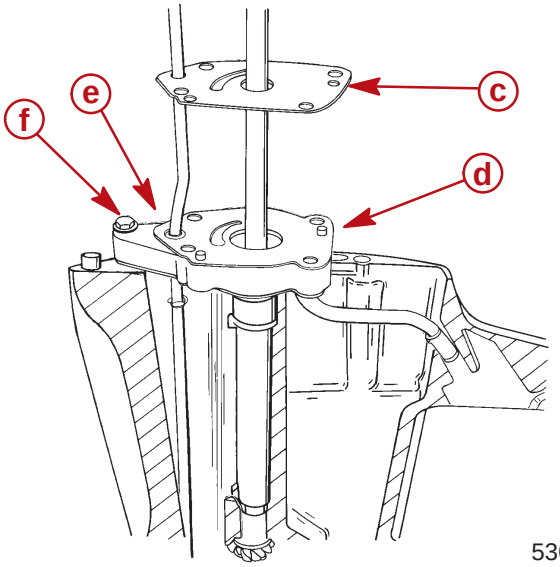
53048

a - Pump cover bolts (4)
b - Cover
c - Nylon washer
d - Impeller
e - Nylon washer
f - Key

4. Remove guide from cover.
5. Replace rubber seal if damaged.
6. Replace cover if inside is grooved.
7. Remove plate, gasket, quad-ring, bolt and washer.
8. Replace plate if grooved.



53032

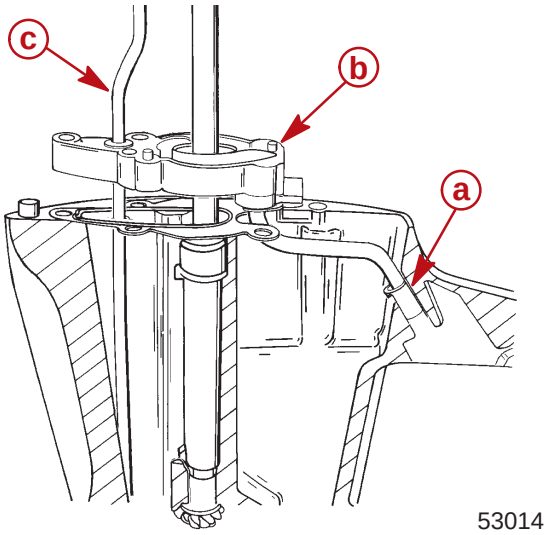


53012

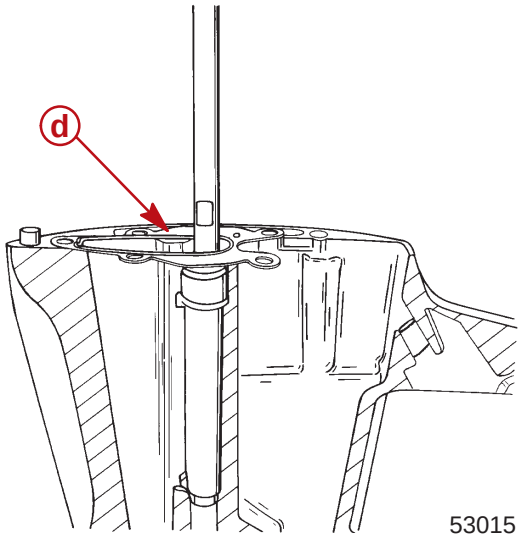
a - Guide
b - Seal
c - Plate
d - Gasket (discard)
e - Quad-ring
f - Bolt and washer

9. Replace seal if damaged.

10. Remove water pump base and shift shaft from housing.
11. Remove gasket.



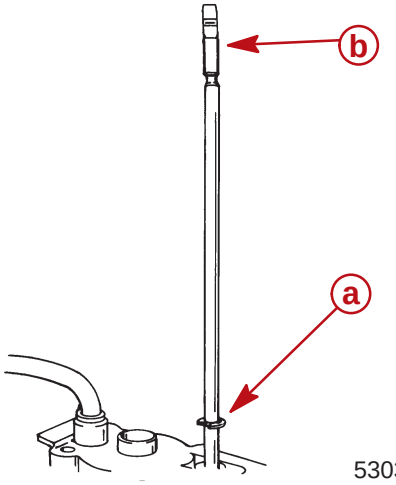
53014



53015

a - Seal
b - Pump base
c - Shift shaft
d - Gasket (discard)

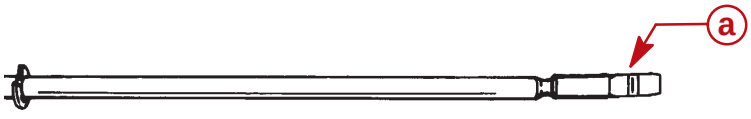
12. Remove clip from shift shaft. Unthread shift cam. Remove shaft from water pump base.



53034

a - Clip
b - Shift cam

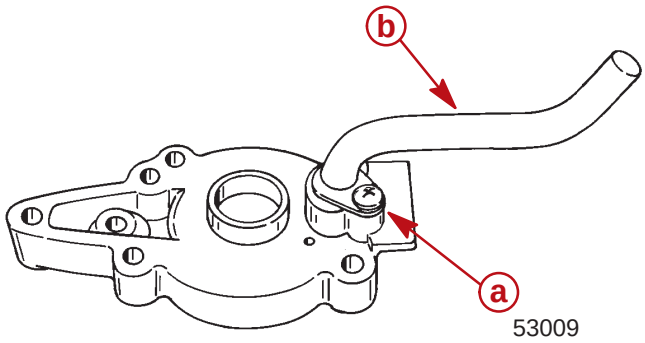
13. Inspect shift cam for wear. Replace if worn.



53034

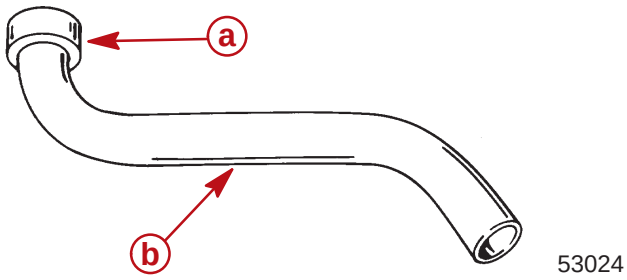
a - Shift cam

14. Remove screw and pull water tube from base.



a - Screw
b - Water tube

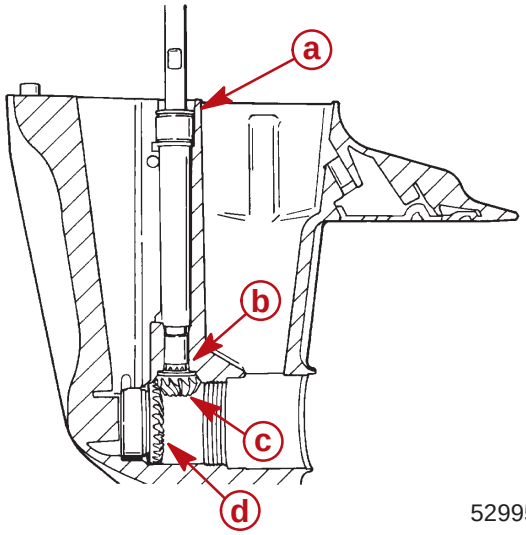
15. Replace seal if damaged. Replace water tube if corroded.



a - Seal
b - Water tube

16. Remove drive shaft from gear housing.

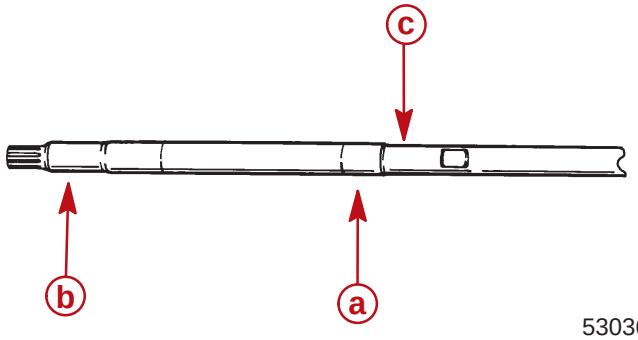
NOTE: *Thrust washers, pinion gear and forward gear assembly are free to fall from housing when drive shaft is removed.*



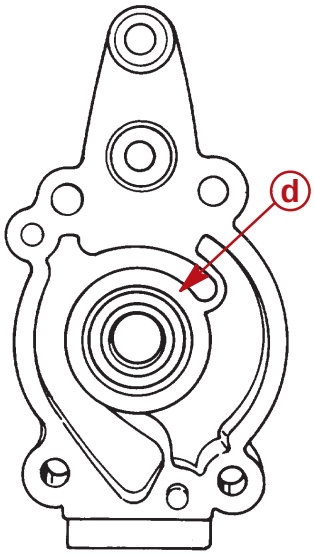
a - Thrust washer (without oil groove)
b - Thrust washer (with oil groove – groove faces down)
c - Pinion gear
d - Forward gear assembly

17. Inspect bearing/bushing surfaces of drive shaft for pitting or wear. If shaft is pitted or worn, replace shaft and corresponding bearing/bushing.

18. Replace drive shaft if the following exist:
    a. Splines are twisted or worn.
    b. Oil seal surface is grooved.
19. Using a screw driver or punch, carefully remove (and discard) seals from pump base.



53036



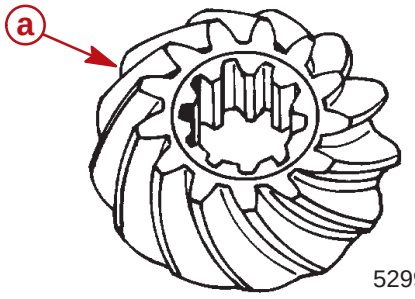
53010

a - Bushing surface
b - Bearing surface
c - Seal surface
d - Seals

Pinion Gear and Forward Gear

PINION GEAR

1. Inspect pinion gear teeth for breakage, rust, chipping or excessive wear.
2. If pinion gear teeth are damaged, inspect FORWARD and REVERSE gear for damage.
3. Replace gears as required.

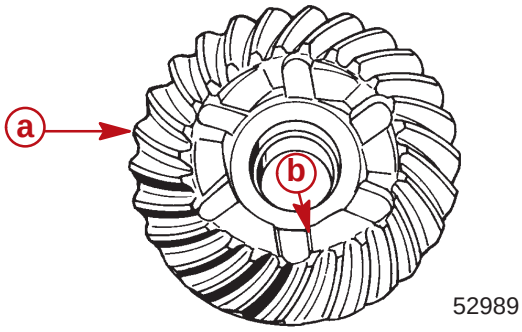


52991

a - Pinion gear

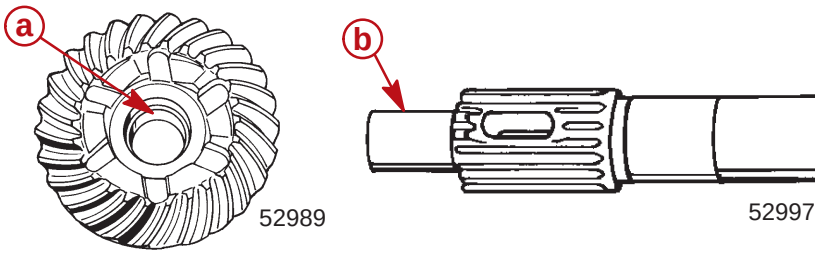
FORWARD GEAR

1. Inspect forward gear teeth for breakage, rust, chipping and excessive wear.
2. Inspect forward gear clutch jaws for wear. Rounded jaws indicate the following:
   a. Improper shift cable adjustment.
   b. Engine idle speed too high.
   c. Shifting too slowly.



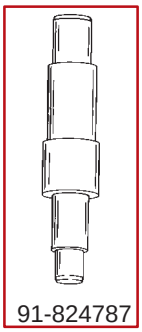
a - Gear teeth
b - Clutch teeth

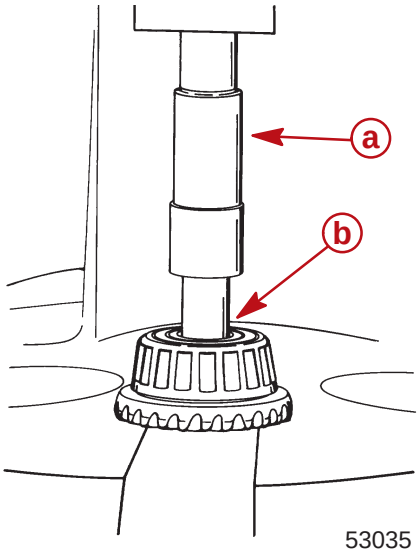
3. Inspect propeller shaft FORWARD gear bushing surface to determine condition of bushing. If surface is discolored from lack of lubricant, pitted or worn, propeller shaft and bushing should be replaced.



a - Bushing
b - Bushing surface

4. If necessary, press bushing from gear using Bushing Removal Tool.



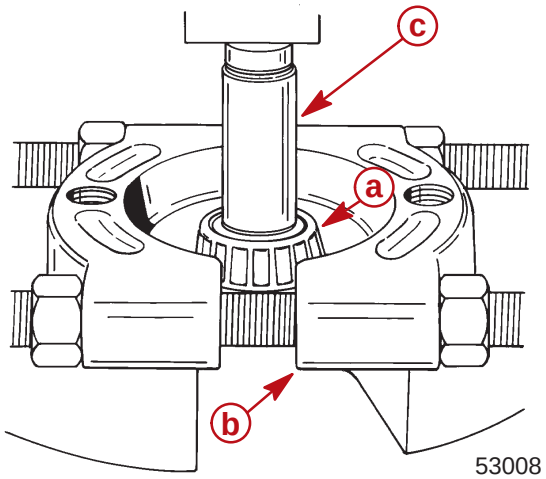


a - Bushing
b - Bushing Removal Tool (91-824787)

IMPORTANT: If FORWARD gear tapered bearing or race requires replacement, replace bearing and race as a set.

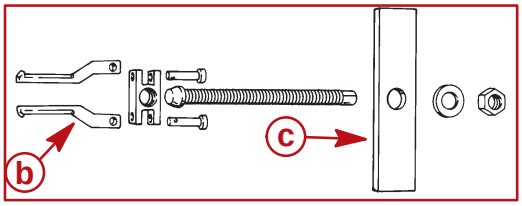
NOTE: *DO NOT remove tapered bearing from FORWARD gear unless replacement is necessary as removal process will damage bearing.*

5. Inspect FORWARD gear tapered bearing and race for rust, roughness or excessive wear.
6. If bearing is in serviceable condition, DO NOT remove bearing from gear as removal process will damage bearing.
7. If bearing must be replaced, remove bearing from gear using Universal Puller Plate and a suitable mandrel.

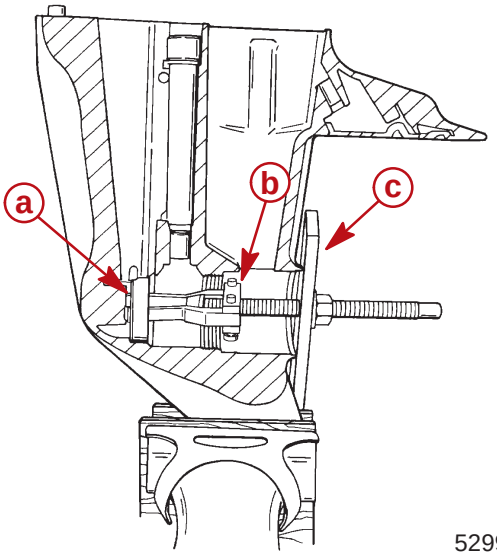


a - Bearing
b - Universal Puller Plate (91-37241)
c - Mandrel

8. Replace FORWARD gear race if it is rusted or damaged or if FORWARD gear tapered bearing must be replaced. Remove race from housing using Bearing Puller Assembly and Puller Plate.



53031

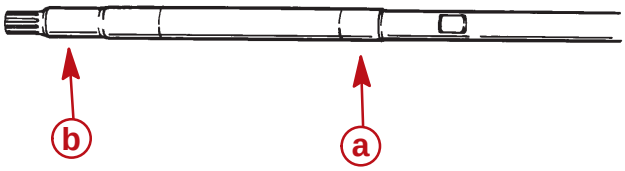


52996

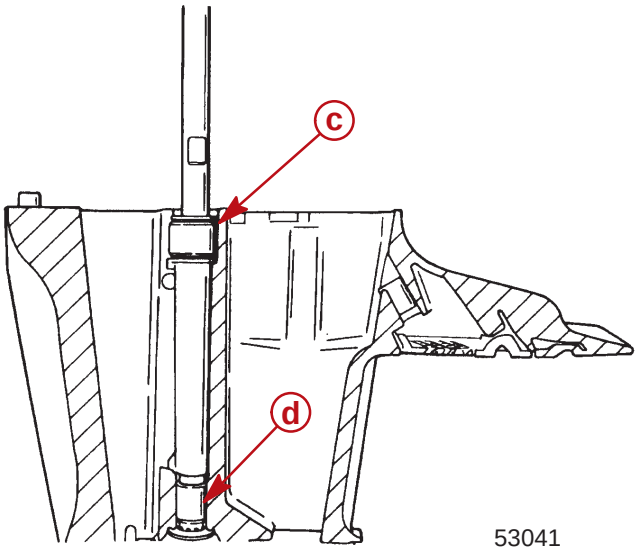
a - Race
b - Bearing Puller Assembly (91-83165M)
c - Puller Plate (91-29310)

Drive Shaft Bushing, Bearing and Lubrication Sleeve

1. Inspect drive shaft bushing and bearing surface to determine condition of corresponding upper drive shaft bushing and lower drive shaft needle bearing. If drive shaft surface is rusted, pitted, discolored (blued – lack of lubrication) or worn; replace drive shaft and corresponding bushing/bearing. DO NOT remove bushing or bearing if replacement is not necessary.



53036



53041

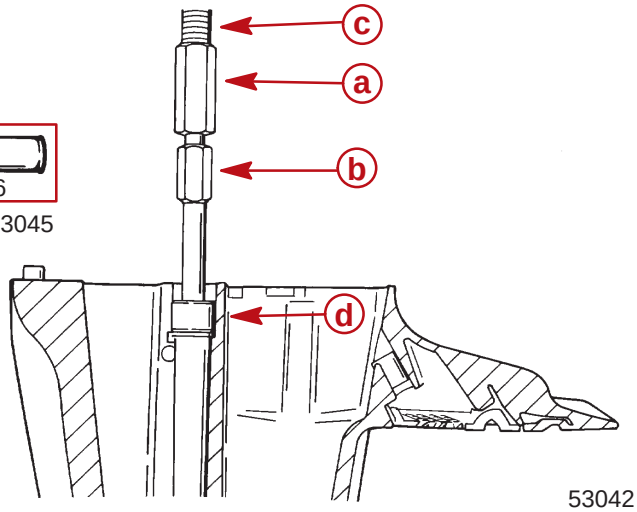
a - Bushing surface
b - Bearing surface
c - Upper drive shaft bushing
d - Lower drive shaft needle bearing

IMPORTANT: If upper drive shaft bushing or lower drive shaft needle bearing appear to be spinning in their respective bores, the gear housing should be replaced.

2. To replace upper drive shaft bushing, use
   Snap On* Expanding Rod (CG 40-4)
   Snap On Collet (CG 40A6)
   Slide Hammer (91-34569A1)
   *Purchase from: Snap On Tools Corporation
   2801 - 80th Street
   Kenosha, WI 53141-1410



53045



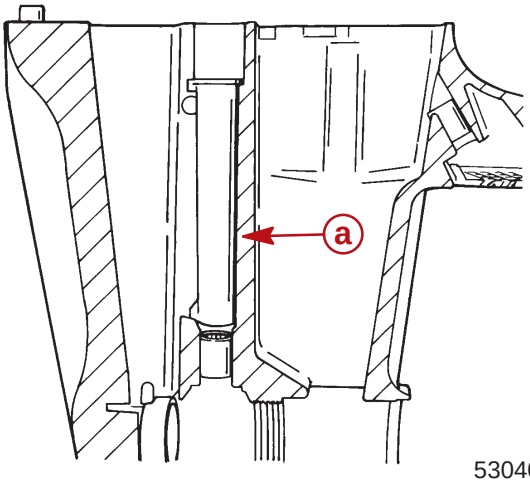
53042

a - Expanding Rod (CG 40-4)
b - Collet (CG 40A6)
c - Slide Hammer (91-34569A1)
d - Bushing

3. To gain access to lower drive shaft needle bearing, remove lubrication sleeve.

NOTE: *When upper drive shaft bushing is installed, a burr may be formed preventing the removal of the lubrication sleeve. Use a knife to remove burr.*

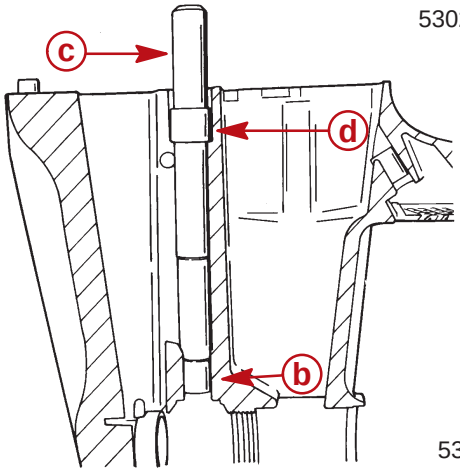
4. Remove needle bearing using Drive Shaft Bearing Removal Tool (91-824788A1).



53040



53029

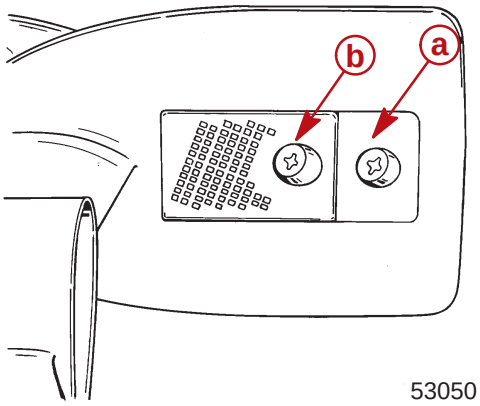


53039

a - Lubrication Sleeve
b - Needle Bearing
c - Driver Shaft Bearing Removal Tool
d - Pilot

Aluminum Anode and Water Inlet

1. Replace aluminum anode if more than 50% consumed.
2. Remove water inlet and check that holes are not obstructed.

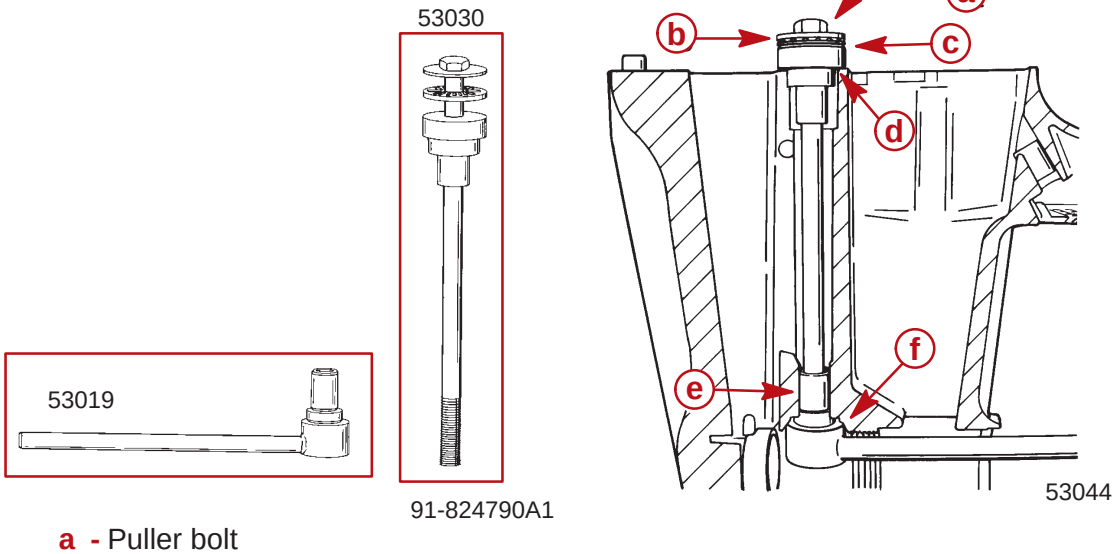


a - Aluminum anode
b - Water inlet

Reassembly

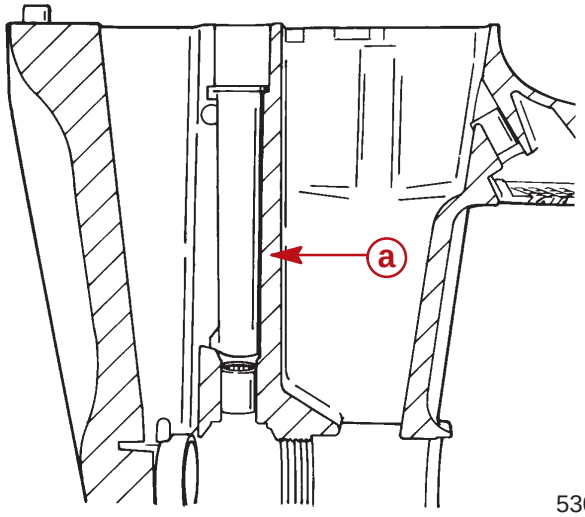
Drive Shaft Needle Bearing, Bushing and Lubrication Sleeve Installation

1. Install lower drive shaft needle bearing (numbers/letters face down) using Drive Shaft Bushing Tool.



a - Puller bolt
b - Flat washer
c - Wafer bearing
d - Pilot
e - Needle bearing
f - Mandrel

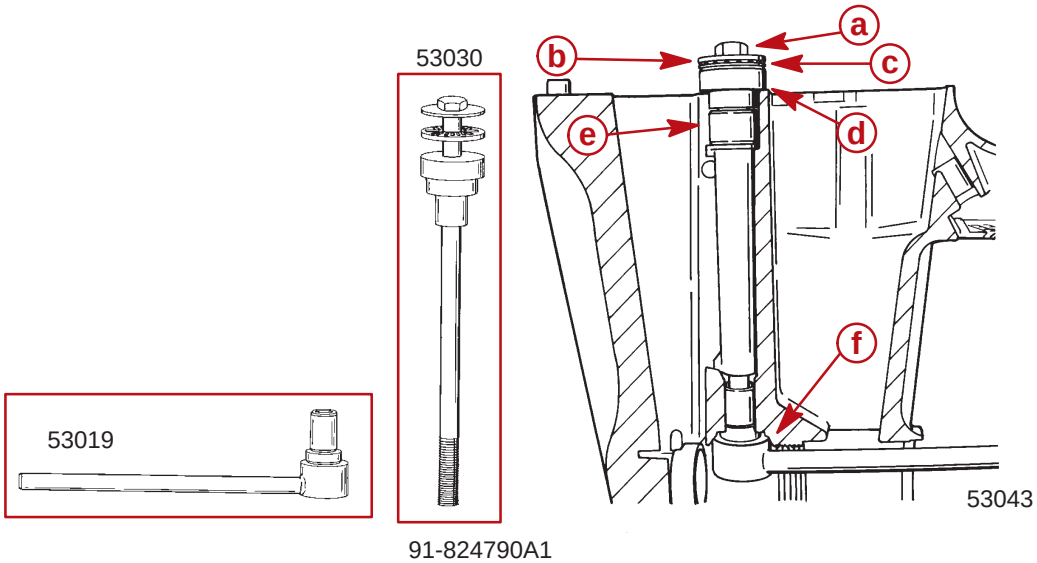
2. Install lubrication sleeve.



a - Sleeve

3. Install upper drive shaft bushing assembly using Drive Shaft Bushing Tool.

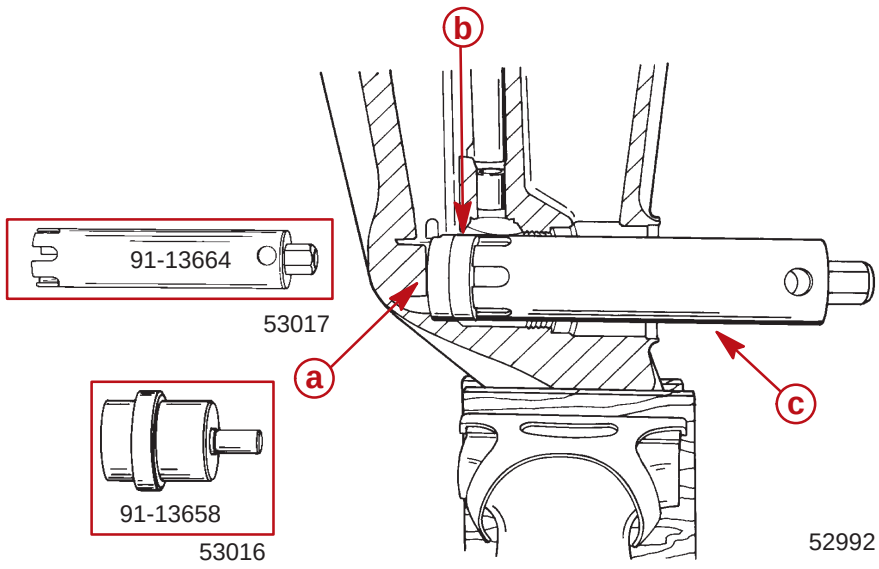
NOTE: *The upper drive shaft bushing is pressed into a sleeve. If the bushing is not worn into the sleeve or the bushing is not spinning within the sleeve, the bushing alone may be replaced. Press the new bushing into the sleeve using a suitable mandrel. If the sleeve is damaged, the bushing/sleeve assembly must be replaced.*



a - Puller bolt
b - Flat washer
c - Wafer bearing
d - Pilot
e - Bushing/Sleeve
f - Mandrel

Forward Gear Bearing Race Installation

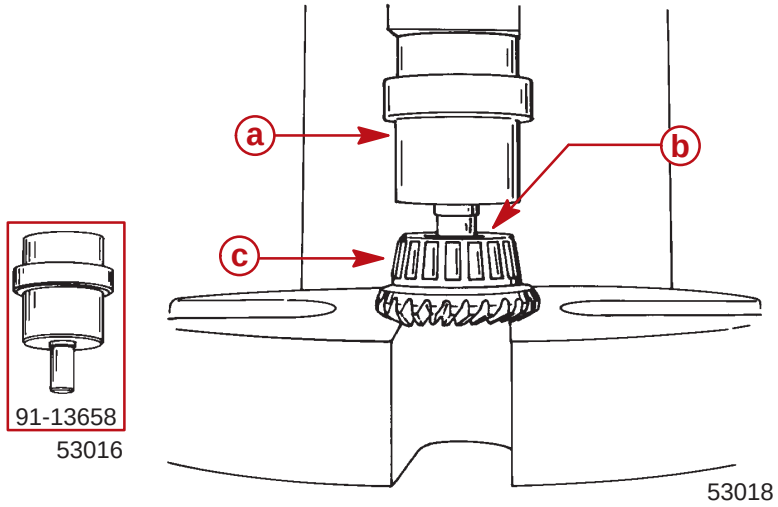
Install race into housing using Mandrel and Bearing Carrier Tool.



a - Race
b - Mandrel (91-13658)
c - Bearing Carrier Tool (91-13664)

Forward Gear Reassembly

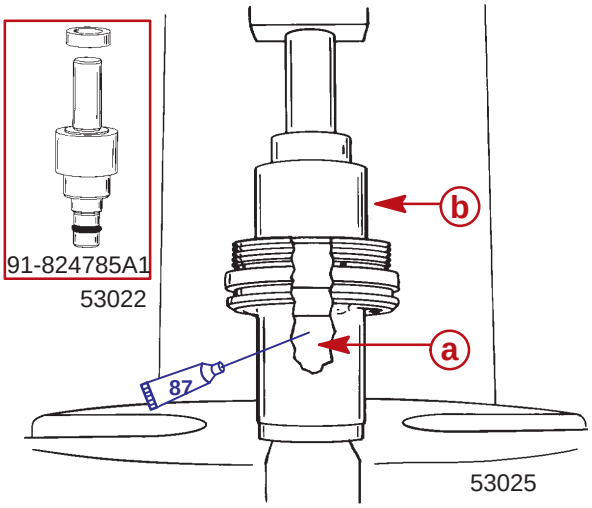
Install bushing and bearing using Mandrel and press.

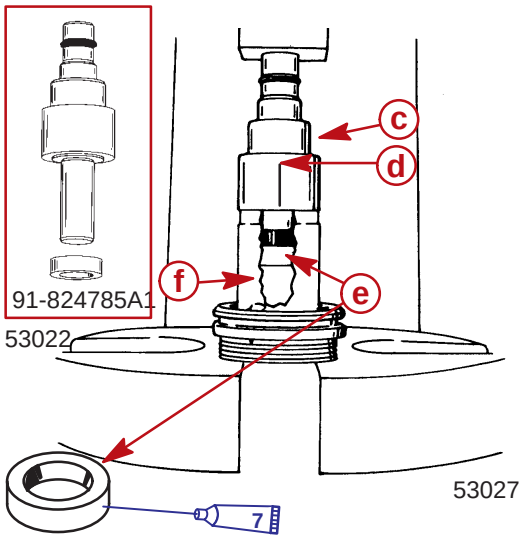


a - Mandrel (91-13658)
b - Bushing
c - Bearing

Bearing Carrier Reassembly

1. Apply High Performance Gear Lubricant to bushing and press bushing into carrier using Mandrel.
2. Apply Loctite 271 to O.D. of seal and with lip facing bushing, press seal into carrier using Mandrel.



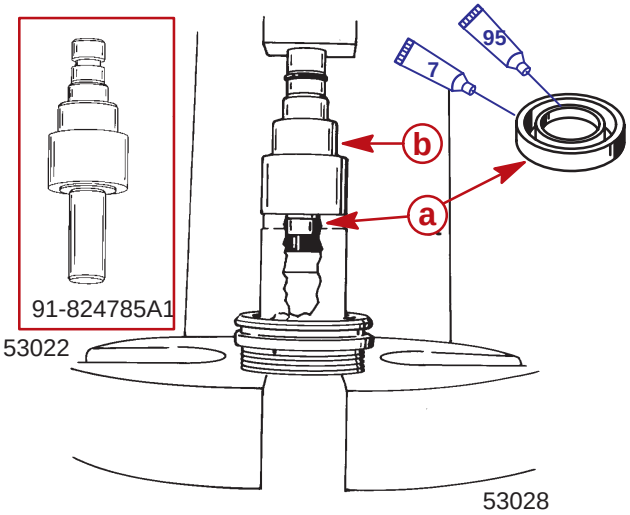


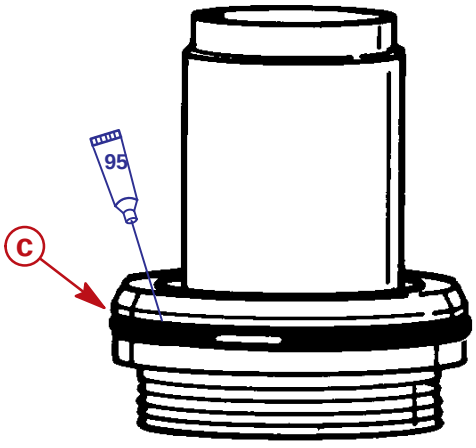
87 High Performance Gear Lubricant

7 Loctite 271

- **a** - Bushing
- **b** - Mandrel (91-824785A1)
- **c** - Mandrel (91-824785A1)
- **d** - Ring (used with mandrel)
- **e** - Seal (LIP FACES BUSHING)
- **f** - Bushing

3. Apply Loctite 271 to O.D. of fishline cutter seal. With ring removed from Mandrel, press seal, with LIP FACING Mandrel, into carrier. Apply 2-4-C with Teflon between lips of both seals.
4. Apply 2-4-C with Teflon to O-ring and install O-ring on carrier.





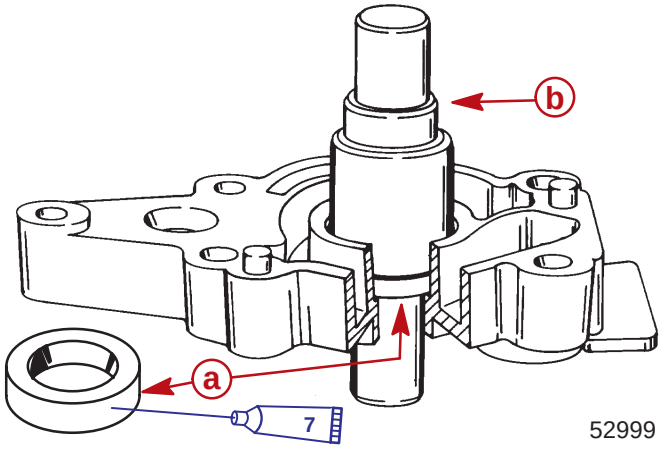
7 Loctite 271

95 2-4-C with Teflon

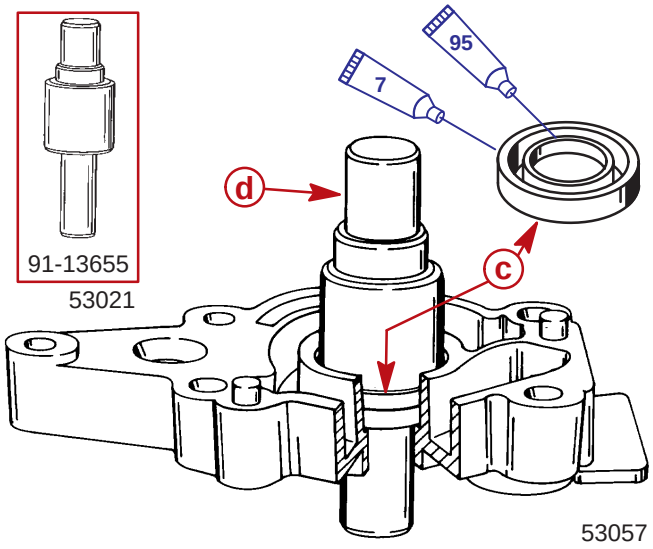
- **a** - Fishline cutter seal (LIP FACES MANDREL)
- **b** - Mandrel (without ring – 91-824785A1)
- **c** - O-ring

Water Pump Base and Shift Shaft Reassembly

1. Apply Loctite 271 to O.D. of seal. With lip of seal facing DOWN, push seal into base using Mandrel.
2. Apply Loctite 271 to O.D. of seal. With seal lip facing UP, push seal into base using Mandrel. Apply 2-4-C with Teflon between lips of both seals.



52999



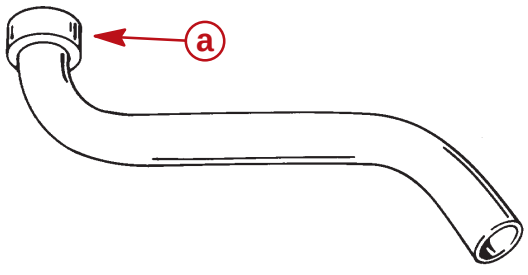
53057

7 Loctite 271

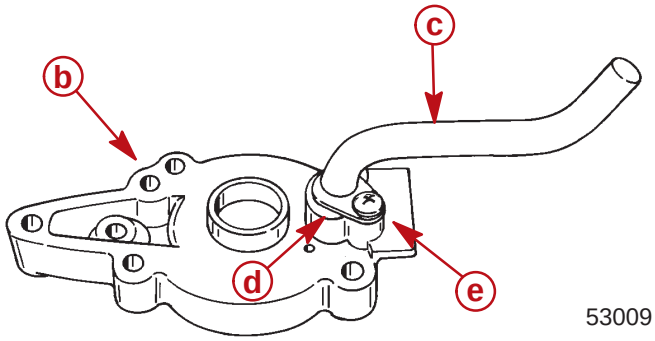
95 2-4-C with Teflon

- **a** - Seal (Lip FACES DOWN)
- **b** - Mandrel (91-13655)
- **c** - Seal (Lip FACES UP)
- **d** - Mandrel (91-13655)

3. Install seal onto water tube.
4. Secure water tube to pump base with retainer and screw.



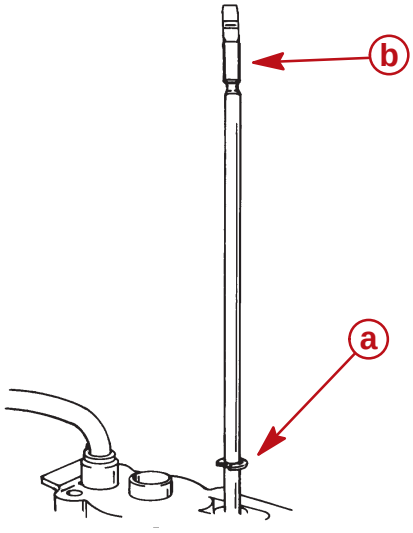
53024



53009

- **a** - Seal
- **b** - Pump base
- **c** - Water tube
- **d** - Retainer
- **e** - Screw

5. Install shift shaft through pump base.
6. Install E-clip on shift shaft. Clip must be below pump base.
7. Thread shift cam onto shaft.

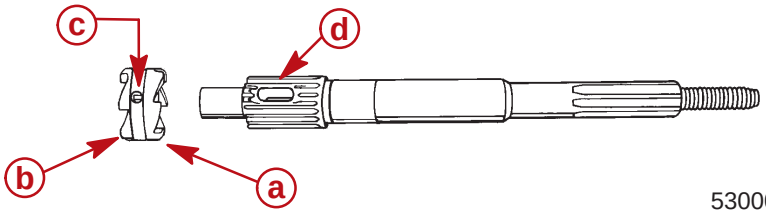


53034

a - E-clip
b - Shift cam

Propeller Shaft Reassembly

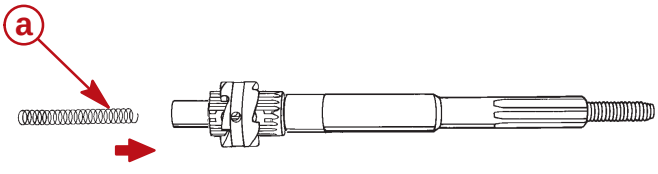
1. Slide clutch onto propeller shaft.



53000

a - Sliding clutch
b - Short end (FORWARD gear side)
c - Hole (must align with slot)
d - Slot

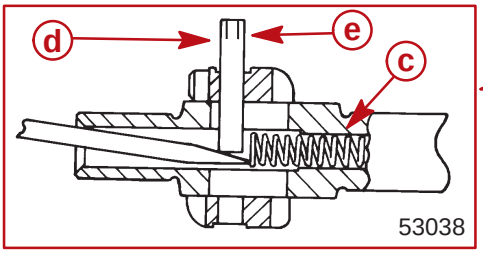
2. Insert cam follower spring into shaft.

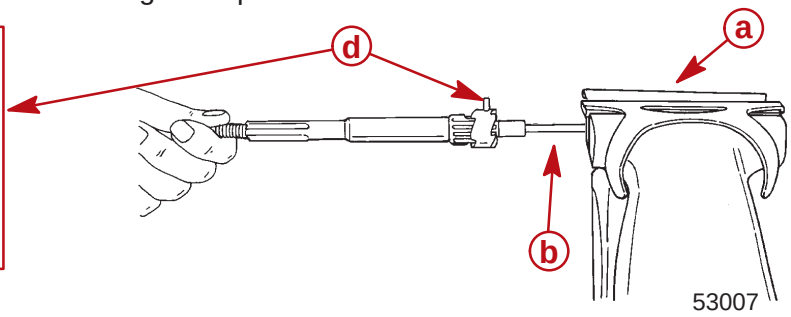


53005

a - Spring

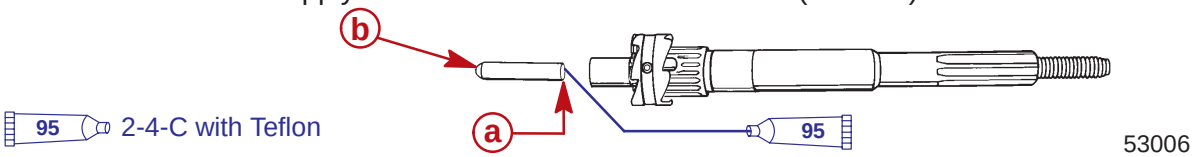
3. Compress spring and install NEW groove pin.





a - Vise
b - Screwdriver or small punch
c - Spring
d - Groove pin (press in until flush)
e - Serrations

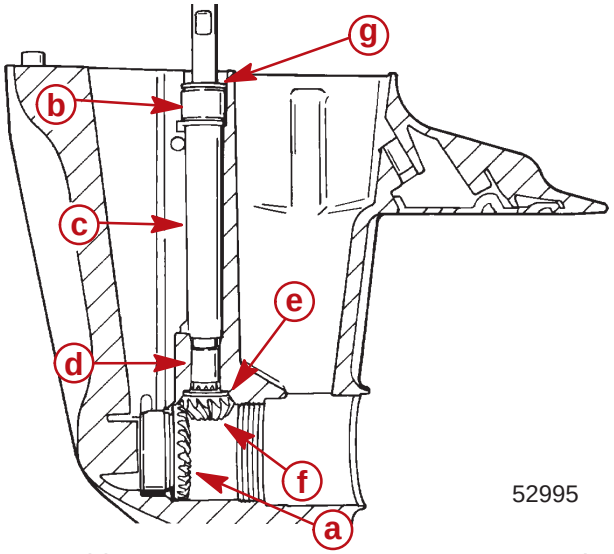
4. Apply 2-4-C with Teflon to cam follower (flat side) and install follower into shaft.



a - Cam Follower
b - Flat Side

Forward Gear, Pinion Gear and Drive Shaft Installation

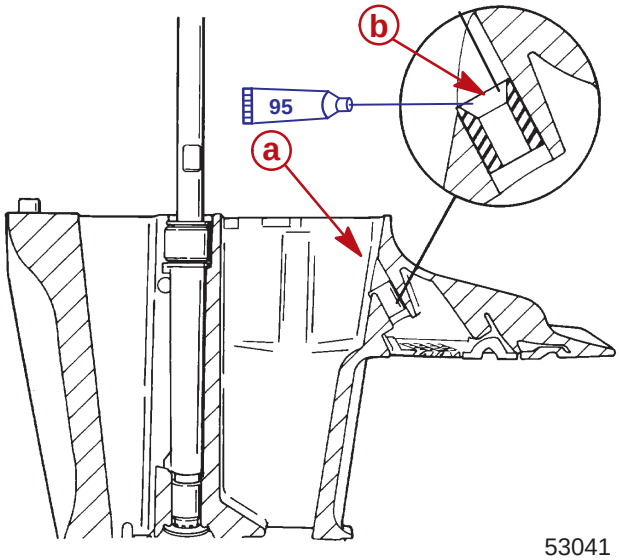
1. Install FORWARD gear assembly into forward gear race.
2. Install drive shaft through upper drive shaft bushing, oil sleeve and lower drive shaft needle bearing.
3. While lifting drive shaft slightly, install lower thrust washer (GROOVED SIDE FACES DOWN) and PINION gear. It may be necessary to rotate drive shaft slightly to engage pinion gear with splines of drive shaft and with forward gear teeth.
4. Install upper thrust washer above upper drive shaft bushing.



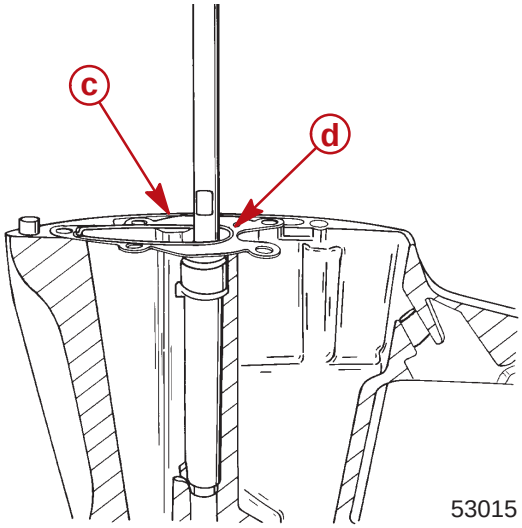
a - FORWARD gear assembly
b - Drive shaft bushing
c - Oil sleeve
d - Needle bearing
e - Lower thrust washer (GROOVED SIDE FACES DOWN)
f - Pinion gear
g - Upper thrust washer

Shift Shaft and Water Pump Base Installation

1. Apply 2-4-C with Teflon to I.D. of seal.
2. Install seal in housing with tapered end facing up.
3. Install base gasket with drain hole positioned as shown.



53041



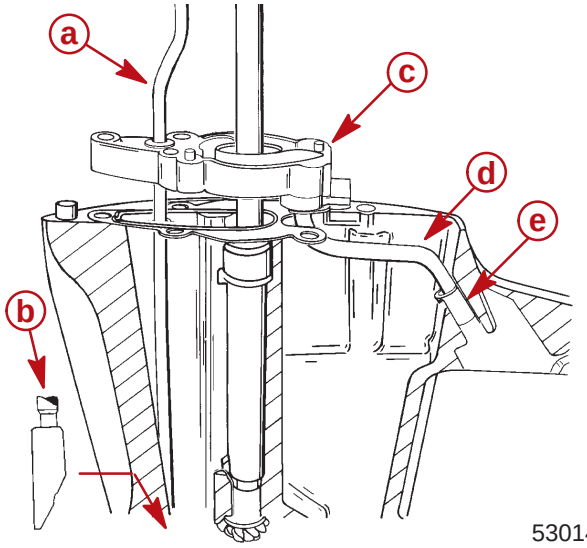
53015

95 2-4-C with Teflon

- **a** - Seal
- **b** - Tapered I.D.
- **c** - Base gasket
- **d** - Hole

IMPORTANT: Verify seal is not pushed out of position when water tube is installed.

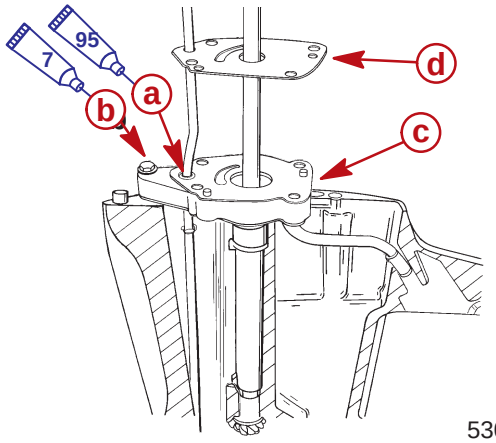
4. Slide water pump base with shift shaft down drive shaft. Align water tube with seal in housing while seating water pump base.



53014

- **a** - Shift shaft
- **b** - Shift cam (POSITION AS SHOWN)
- **c** - Pump base
- **d** - Water tube
- **e** - Seal

5. Apply 2-4-C with Teflon to I.D. and O.D. of shift shaft quad ring. Seat quad ring in pump base.
6. Apply Loctite 271 to bolt threads and secure pump base to housing with bolt and washer. Torque bolt to 5.6 Nm (50 lb in.).
7. Install gasket and face plate.



53012

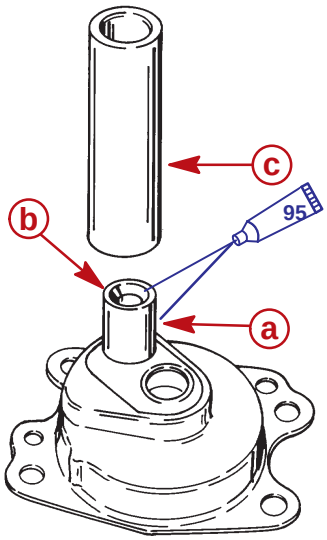
7 Loctite 271

95 2-4-C with Teflon

a - Quad ring
b - Bolt and washer [Torque to 5.6 Nm (50 lb. in.)]
c - Gasket
d - Face plate

Water Pump Cover Reassembly

1. Apply 2-4-C with Teflon to O.D. of seal and seal surface.
2. Install seal into cover.
3. Place water tube guide onto seal.



53032

95 2-4-C with Teflon

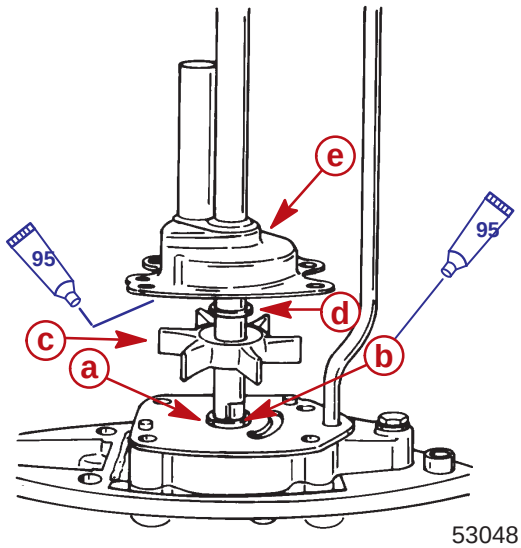
a - Seal
b - Seal surface
c - Guide

Impeller and Pump Cover Installation

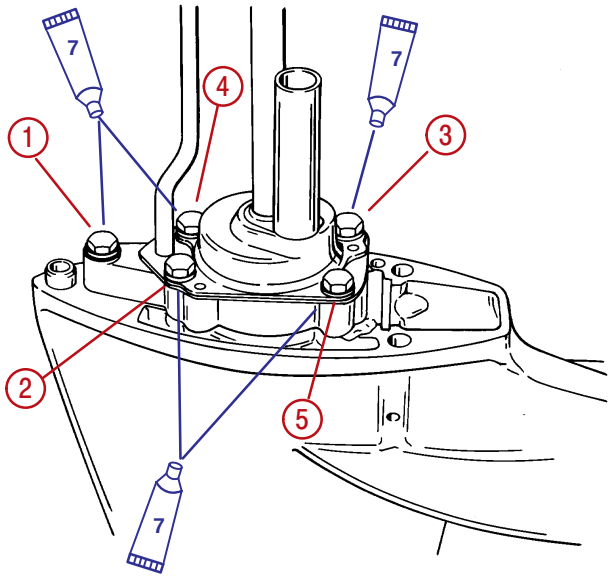
1. Install neoprene washer.
2. Install drive key. Use 2-4-C with Teflon to hold key to drive shaft.

IMPORTANT: It is recommended that the impeller be replaced regardless of appearance. If impeller must be reused, it must be installed in the direction of original rotation. Installing impeller with vanes reversed from their previous set will result in vane breakage shortly after unit is returned to service.

3. Install new impeller and align with drive key.
4. Install neoprene washer.
5. Lubricate I.D. of water pump cover with 2-4-C with Teflon.
6. Install cover on drive shaft and while pushing down on cover, rotate drive shaft CLOCKWISE and install cover over impeller.
7. Apply Loctite 271 to threads of bolts. Secure cover with bolts and torque to 5.6 Nm (50 lb. in.) per following numbered torque sequence.



53048



53023

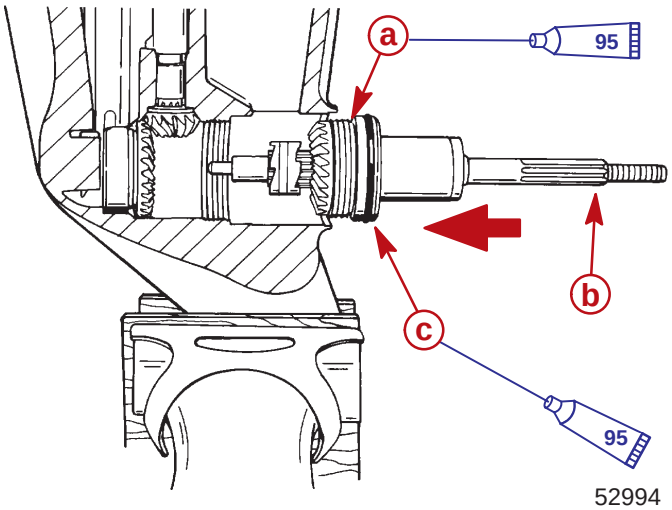
7 Loctite 271

95 2-4-C with Teflon

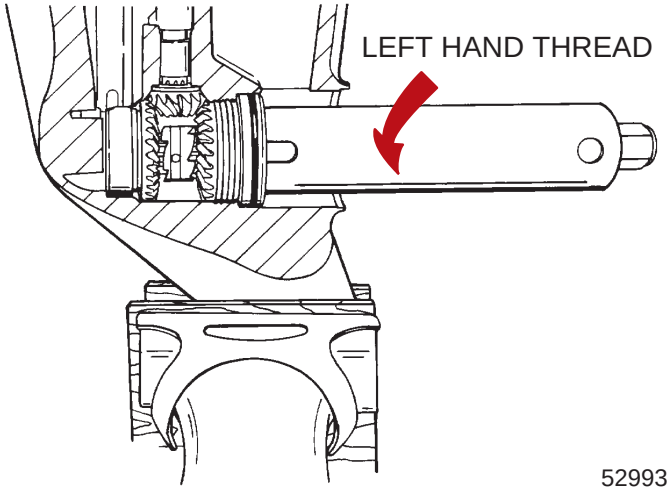
a - Neoprene washer
b - Drive key
c - Impeller
d - Neoprene washer
e - Cover

Propeller Shaft and Bearing Carrier Installation

1. Install REVERSE gear into bearing carrier.
2. If not previously lubricated, apply 2-4-C with Teflon to o-ring.
3. Apply 2-4-C with Teflon to bearing carrier threads and pilot diameter.
4. Slide bearing carrier onto propeller shaft and install entire assembly into gear housing.
5. Torque bearing carrier to 115.2 Nm (85 lb. ft.) using Bearing Carrier Tool (91-13664).



52994



52993

95 2-4-C with Teflon

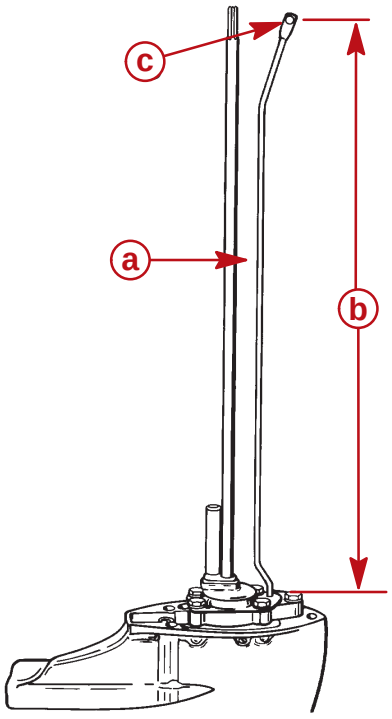
a - Bearing carrier threads
b - Propeller shaft
c - Pilot diameter

Installation

⚠ WARNING

To prevent accidental engine starting, remove and isolate spark plug leads from spark plugs. BEFORE installing gear housing.

1. Remove and isolate spark plugs leads from spark plugs.
2. Place shift linkage on engine in FORWARD gear position.
3. Tilt engine to full up position.
4. Place gear housing in NEUTRAL. Propeller will rotate freely in either direction when gear housing is in NEUTRAL.
5. Position shift shaft as shown when measuring distance in Step 6.
6. Distance between top of water pump base and center of hole, must be as specified below. Turn shift shaft clockwise to decrease distance or counter clockwise to increase distance.

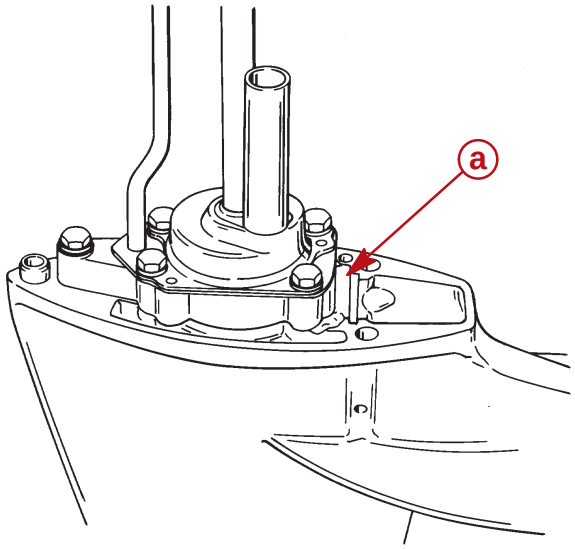


53051

a - Shift shaft
b - Shaft distance
c - Center of hole

Drive Shaft Length	Distance
Short	419mm (16-1/2 in.)
Long	559mm (22 in.)
Extra Long	698mm (27-1/2 in.)

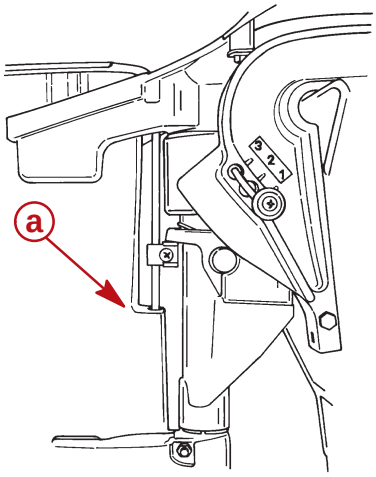
7. Place gear housing in FORWARD gear. Gear housing will ratchet when propeller shaft is turned clockwise.
8. Apply a 6.4mm (1/4 in.) diameter bead of RTV Sealer on water pump base.



53023

a - RTV Sealer

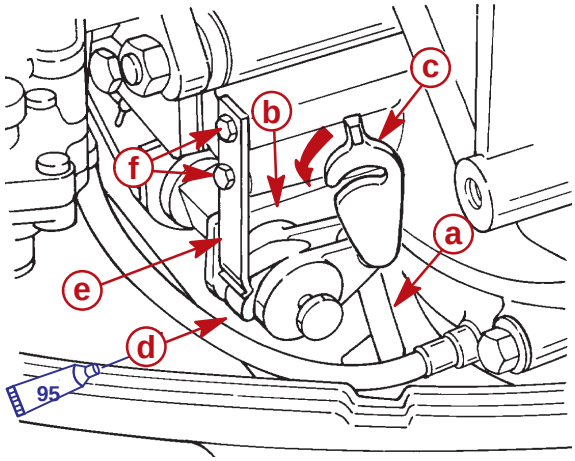
9. Install gear housing as follows:
   a. Position gear housing so that drive shaft and shift shaft extend into drive shaft housing.
   b. Move gear housing toward drive shaft housing while keeping mating surfaces parallel.
   c. Guide shift shaft through hole in mid-section.
   d. Guide water tube into water tube guide.
   e. Rotate propeller counterclockwise while pushing upward on gear housing to align drive shaft splines with crankshaft splines.
   f. Guide end of shift shaft into shift coupling yoke under cowl.



53004

a - Shift shaft hole

10. Secure detent spring to block with 2 bolts. Spring may have slotted holes. Install spring so that it is raised UP and at end of slot travel. Torque bolts to 2.8 Nm (25 lb. in.).
11. Secure end of shift shaft to yoke of horizontal shift shaft with coupler. Rotate coupler until it locks in place.

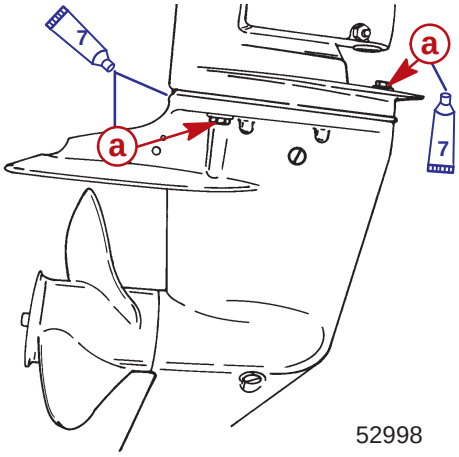


53052

95 2-4-C with Teflon

a - Shift shaft
b - Yoke
c - Coupler
d - Apply 2-4-C with Teflon
e - Detent spring
f - Bolts [Torque to 2.8 Nm (25 lb. in.)]

12. Apply Loctite 271 to 3 bolts and torque to 20.3 Nm (15.0 lb. ft.).



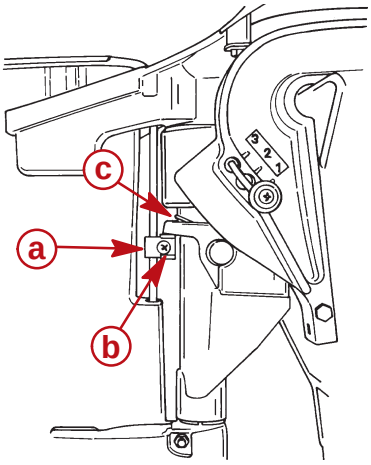
52998

7 Loctite 271

a - Bolts [Torque to 20.3 Nm (15.0 lb. ft.)]

13. Check shift operation as follows:
    a. Place shift lever in FORWARD. Gear housing should ratchet when propeller shaft is turned clockwise and resistance should be felt when propeller is turned counterclockwise.
    b. Place shift lever in NEUTRAL. Resistance should NOT be felt when propeller shaft is rotated in either direction.
    c. Place shift lever in REVERSE. Resistance should be felt when propeller shaft is rotated in either direction.
    d. If shift operation is not as described, remove gear housing and recheck distance measurement in Step 6.
14. Place shift lever in NEUTRAL.

15. Install reverse lock actuator loosely on shift shaft.
16. Position reverse lock actuator so that it just contacts reverse lock hook; secure in this position. Torque actuator screw to 5.1 Nm (45 lb. in.). The outboard will now ONLY TILT UP IN FORWARD GEAR. If the operator wishes the outboard to tilt up in FORWARD and NEUTRAL, place shift lever in REVERSE. Install reverse lock actuator loosely on shift shaft. Position actuator so that 6.4mm (0.25 in.) clearance exists between reverse lock hook and actuator. Secure actuator in this position. Torque actuator screw to 5.1 Nm (45 lb. in.).



53004

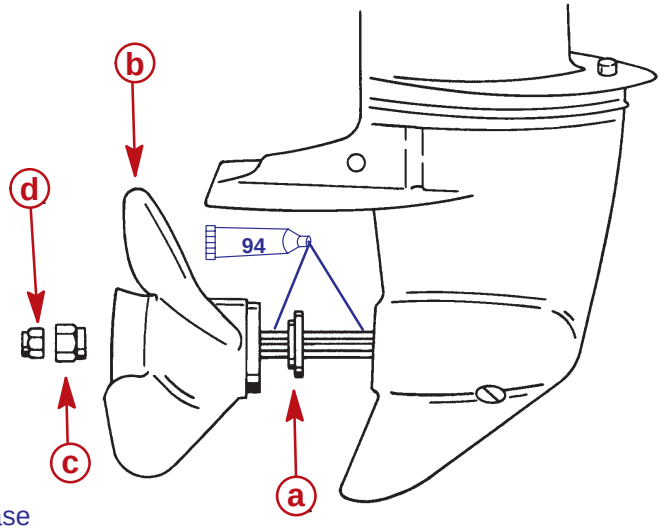
a - Reverse lock actuator
b - Screw and locknut [Torque to 5.1 Nm (45 lb. in.)]
c - Reverse lock hook

Propeller Installation

⚠ WARNING

If gear housing is NOT removed from drive shaft housing, BEFORE attempting to remove or install the propeller, remove (and isolate) spark plug leads from spark plugs to prevent engine from starting accidentally.

1. Apply Anti-Corrosion Grease to propeller shaft.
2. Install inner thrust hub.
3. Slide propeller onto shaft.
4. Install outer thrust hub.
5. Thread propeller nut onto shaft.

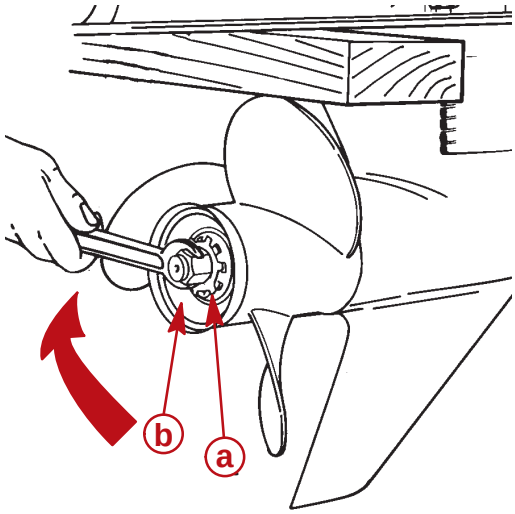


94 Anti-Corrosion Grease

52547

a - Inner thrust hub
b - Propeller
c - Outer thrust hub
d - Propeller nut

6. Place a block of wood between propeller and anti-ventilation plate to prevent propeller from turning and to protect hands. Torque nut to 7.9 Nm (70 lb. in.).



a - Outer thrust hub
b - Nut

Filling Gear Housing with Lubricant

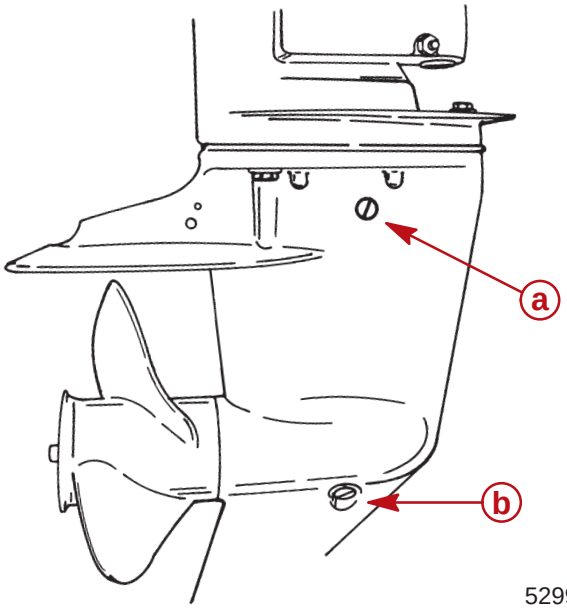
NOTE: *Gear housing lubricant capacity – 6.8 oz. (200 ml).*

IMPORTANT: DO NOT use automotive grease in the gear housing. Use Premium Gear Lubricant or High Performance Gear Lubricant

1. Remove any gasket material from “FILL” and “VENT” screws and housing.
2. Install new gaskets on “FILL” and “VENT” screws.

IMPORTANT: Never apply lubricant to gear housing without first removing “VENT” screw or gear housing cannot be filled because of trapped air. Fill gear housing ONLY when housing is in a vertical position.

3. Slowly fill housing through “FILL” hole until lubricant flows out of “VENT” hole and no air bubbles are present.
4. Reinstall “VENT” screw.
5. Remove grease tube from “FILL” hole and quickly install “FILL” screw.



52998

a - Vent screw
b - Fill screw

ATTACHMENTS/CONTROL LINKAGE

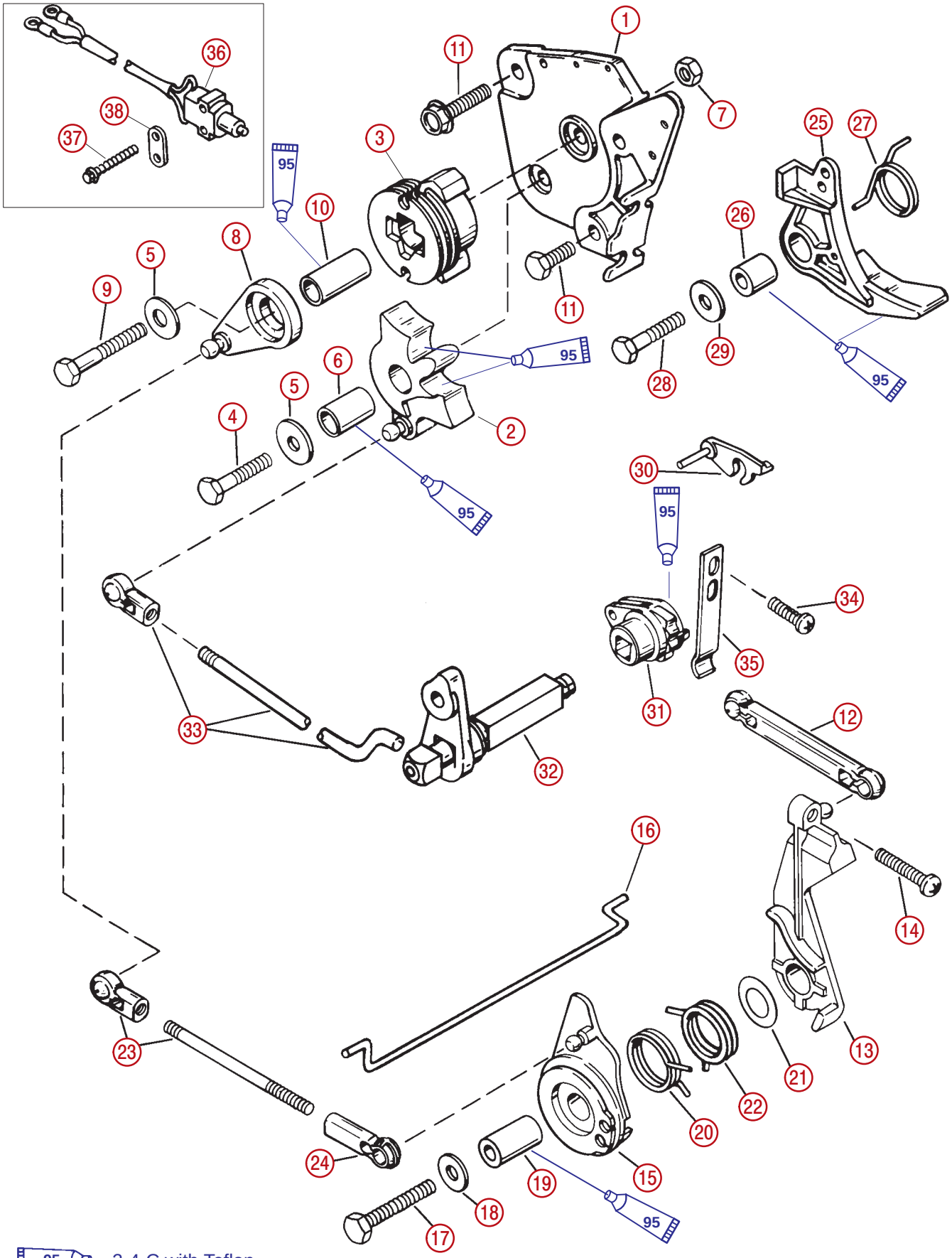
Section 7A – Throttle/Shift Linkage (Tiller Handle Shift Models)

Table of Contents

Throttle and Shift Linkage (Tiller Handle Shift) 7A-2
Control Cables (Tiller Handle Shift) 7A-4
Removal/Installation 7A-4
Control Platform 7A-4
Removal/Disassembly 7A-4
Reassembly/Installation 7A-5
Throttle Cam/Control Lever 7A-8
Removal 7A-8
Reassembly 7A-8
Installation 7A-10
Neutral Interlock Control Lever 7A-11
Reassembly/Installation 7A-11
Horizontal Shift Shaft 7A-12
Reassembly/Installation 7A-12

7
A

Throttle and Shift Linkage (Tiller Handle Shift)



95 2-4-C with Teflon

Throttle and Shift Linkage (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CONTROL PLATFORM			
2	1	GEAR			
3	1	GEAR			
4	1	SCREW (M6 x 30)			
5	2	WASHER			
6	1	SPACER (SHORT)			
7	2	NUT	60		6.8
8	1	PRIMARY LEVER			
9	1	SCREW (M6 x 40)			
10	1	SPACER (LONG)			
11	2	SCREW (M6 x 16)	60		6.8
12	1	TIMING LINK			
13	1	CONTROL LEVER			
14	1	SCREW (M5 x 8 x 35)			
15	1	ACTUATOR			
16	1	LINK			
17	1	SCREW (M6 x 40)	70		7.9
18	1	WASHER			
19	1	BUSHING			
20	1	SPRING			
21	1	LOCKWASHER			
22	1	SPRING			
23	1	THROTTLE LINK			
24	1	SOCKET			
25	1	LEVER			
26	1	BUSHING			
27	1	SPRING			
28	1	SCREW (M6 x 30)	70		7.9
29	1	WASHER			
30	1	LEVER			
31	1	LEVER			
32	1	SHIFT SHAFT			
33	1	SHIFT LINK			
34	2	SCREW (M5 x 8 x 8)	25		2.8
35	1	SPRING			
36	1	SWITCH ASSEMBLY			
37	2	SCREW (20MM) **15 ELECTRIC HANDLE**			
38	1	PLATE			

Control Cables (Tiller Handle Shift)

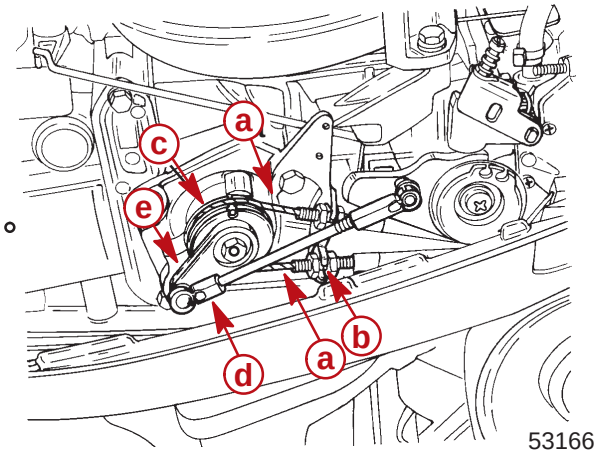
Removal/Installation

Refer to **Section 7C** for removal and installation instructions.

Control Platform

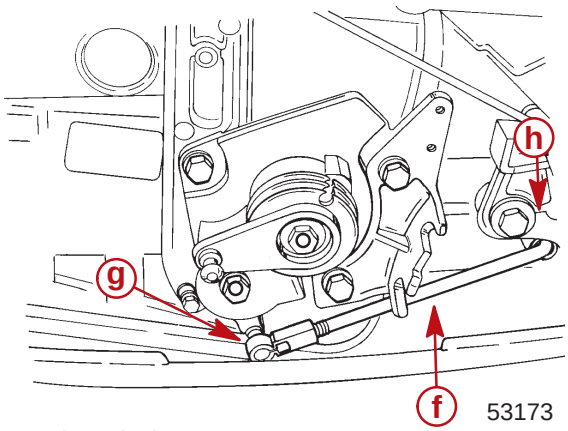
Removal/Disassembly

1. Disconnect control cables from anchor bracket and pulley as outlined in **Section 7C**.
2. Disconnect throttle link rod from ball joint of primary throttle lever.
3. Disconnect shift link rod from ball joint of gear shift lever.



53166

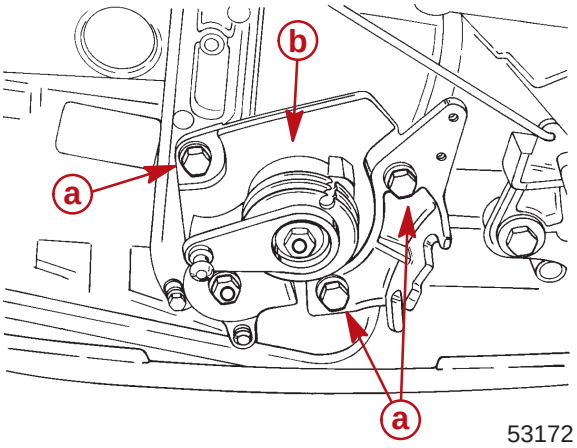
a - Cables
b - Bracket
c - Pulley
d - Link rod



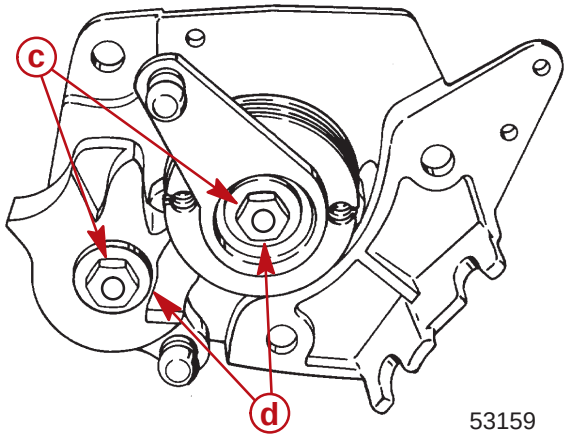
53173

e - Throttle lever
f - Shift link rod
g - Gear shift lever
h - Shift lever

4. Remove 3 bolts and control platform.
5. Remove nuts and flat washers.



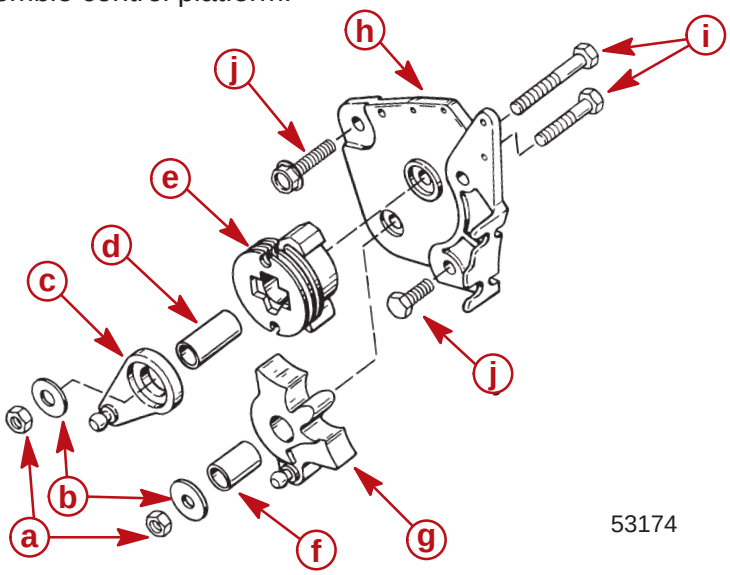
53172



53159

a - Bolts
b - Control platform
c - Nuts
d - Flat washers

6. Disassemble control platform.

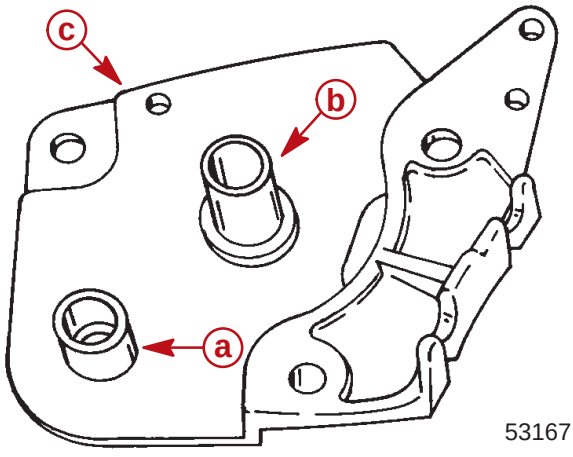


53174

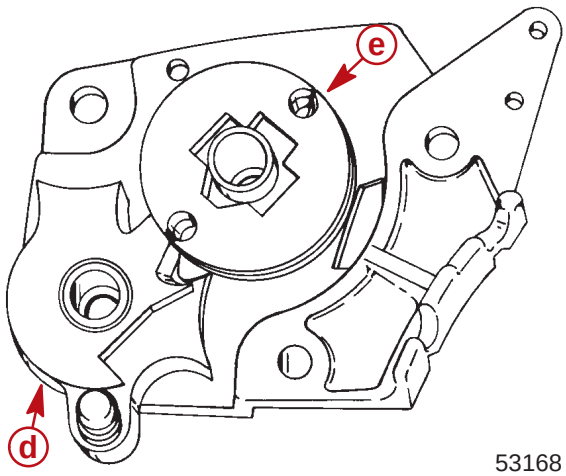
a - Nuts (2) [Torque to 6.8 Nm (60 lb. in.)]
b - Flatwashers (2)
c - Primary throttle lever
d - Spacer (long)
e - Secondary gear
f - Spacer (short)
g - Gear shift lever
h - Control platform
i - Bolts (2)
j - Mount bolts [Torque to 6.8 Nm (60 lb. in.)]

Reassembly/Installation

1. Install short spacer and long spacer into recesses of control platform.
2. Lubricate spacers and area of platform traveled by gears with 2-4-C with Teflon.
3. Install gear shift lever and secondary gear over spacers and lubricate gear teeth with 2-4-C with Teflon.



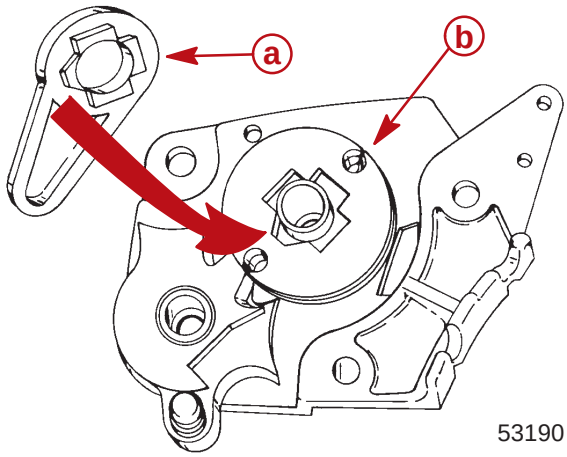
53167



53168

a - Short spacer
b - Long spacer
c - Platform
d - Gear shift lever
e - Secondary gear

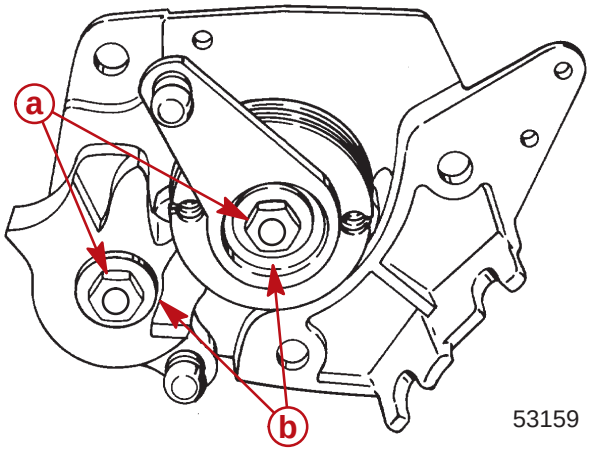
4. Index primary throttle lever into secondary gear.



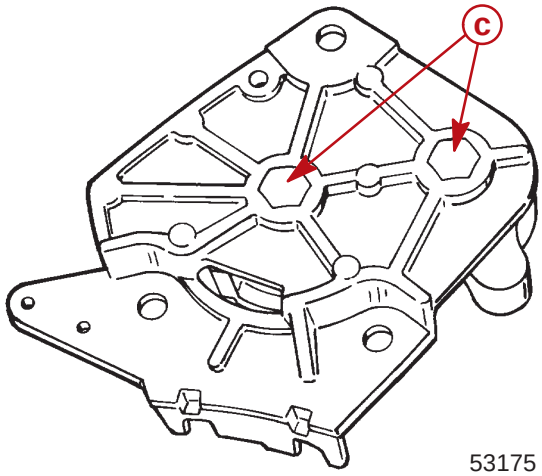
53190

a - Primary throttle lever
b - Secondary gear

5. Install bolts, washers and nuts. Torque nuts to 6.8 Nm (60 lb. in.).



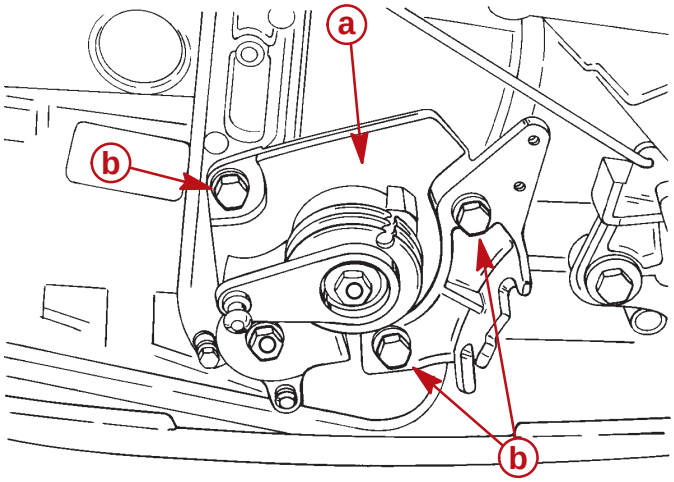
53159



53175

a - Nuts [Torque to 6.8 Nm (60 lb. in.)]
b - Washers
c - Bolts

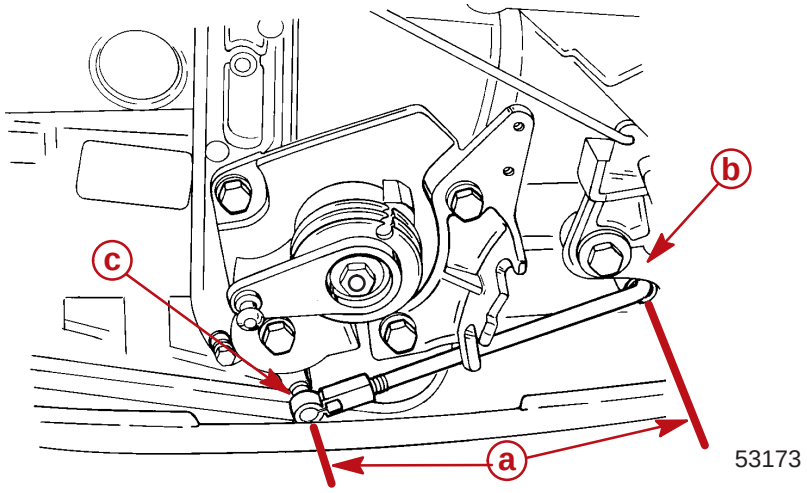
6. Secure assembled control platform onto cylinder block using 3 bolts. Torque bolts to 6.8 Nm (60 lb. in.).



53172

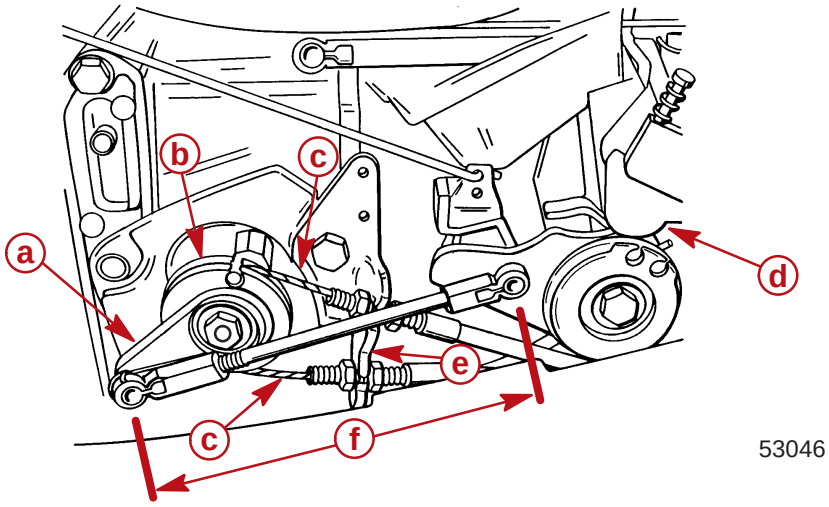
a - Platform
b - Bolts [Torque to 6.8 Nm (60 lb. in.)]

7. Adjust shift link rod to a length of 13.0 cm (5-1/8 in.) as measured between ball joint centerlines.
8. Connect shift link rod between joints of gear shift lever and shift shaft lever.



a - Shift link rod [Adjust to length of 13.0 cm (5-1/8 in.)]
b - Shift shaft lever
c - Gear shift lever

9. Adjust throttle link rod to a length of 12.4 cm (4-7/8 in.) as measured between ball joint centerlines.
10. Connect throttle link rod between ball joints of primary throttle lever and throttle cam.
11. Connect control cables to pulley of secondary gears and anchor bracket as outlined in **Section 7C**.

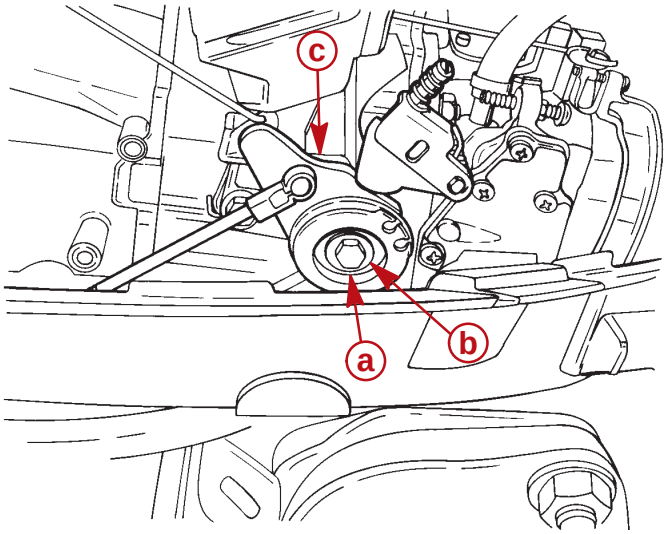


a - Primary throttle lever
b - Pulley
c - Control cables
d - Throttle cam
e - Anchor bracket
f - Throttle link rod [Adjust to length of 12.4cm (4-7/8 in.)]

Throttle Cam/Control Lever

Removal

1. Refer to **Section 7C** for removal of throttle cables.
2. Remove bolt and flat washer securing cam/lever to powerhead.

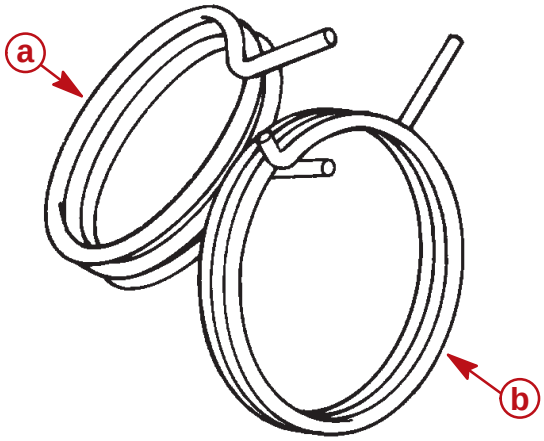


53162

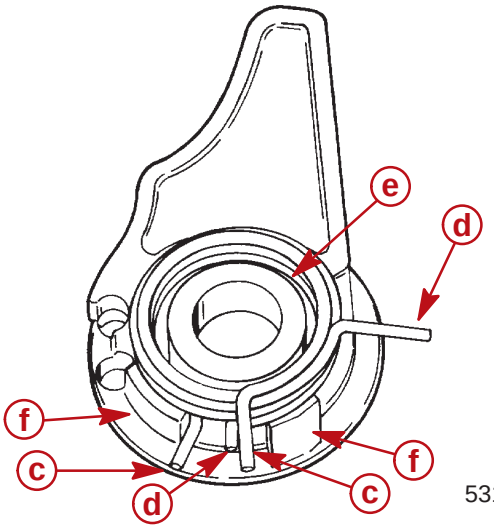
a - Bolt
b - Washer
c - Cam/lever

Reassembly

1. Assemble inner spring and outer spring together.
2. Position spring assembly over hub of throttle cam.



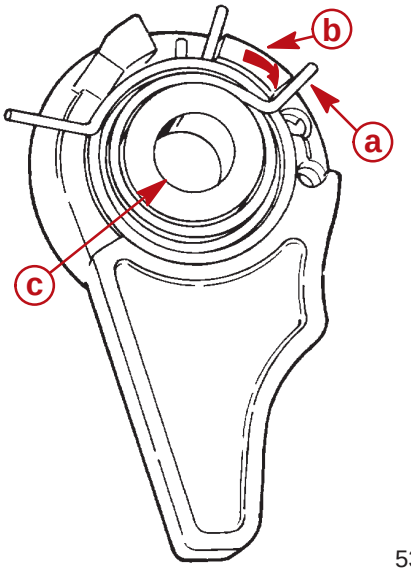
53182



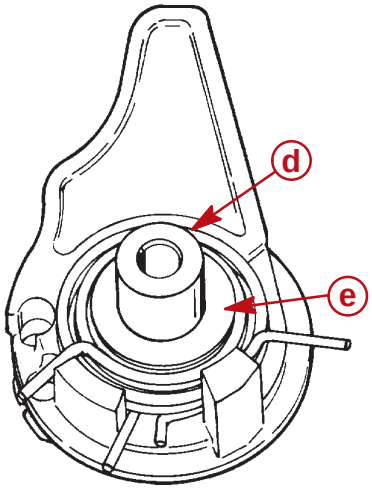
53177

a - Inner spring
b - Outer spring
c - Inner spring ends
d - Outer spring ends
e - Hub
f - Tabs

3. Wind end of inner spring to position tab of cam between inner spring ends. Verify spring windings are firmly held around diameter of cam hub and that no windings are positioned on top of hub.
4. Lubricate bushing with 2-4-C with Teflon and install bushing and wave washer.



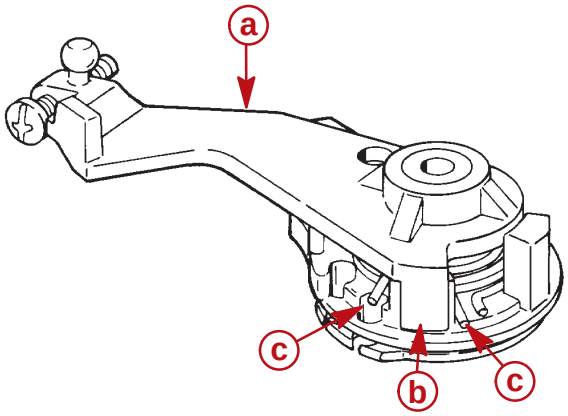
53178



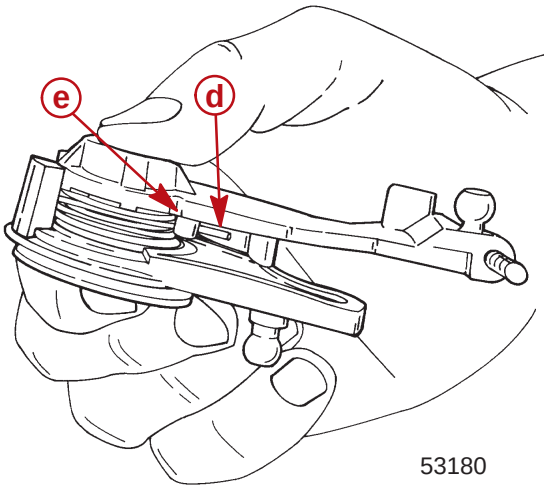
53176

a - Inner spring end
b - Tab
c - Cam hub
d - Bushing
e - Wave washer

5. Install control lever onto throttle cam assembly so that tab of control lever is positioned between ends of inner spring.
6. Hook longer spring end of outer spring behind peg of control lever.



53179

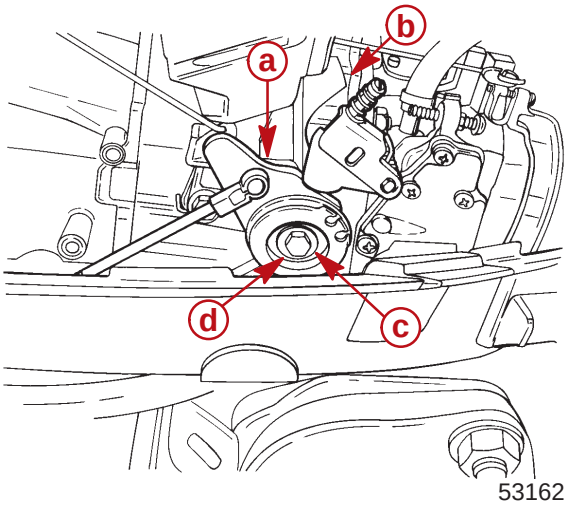


53180

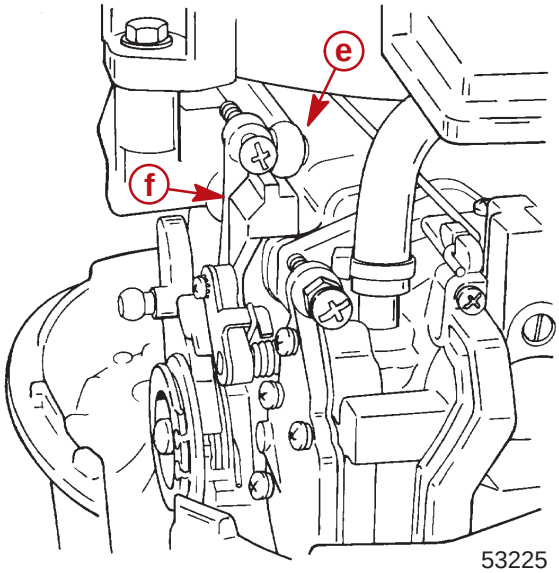
a - Control lever
b - Tab
c - Ends of inner spring
d - Longer spring end
e - Peg

Installation

1. Secure throttle cam/control lever assembly onto mounting boss of crankcase cover with bolt. Torque bolt to 7.9 Nm (70 lb. in.).
2. Connect timing link between ball joints of control lever and trigger assembly.



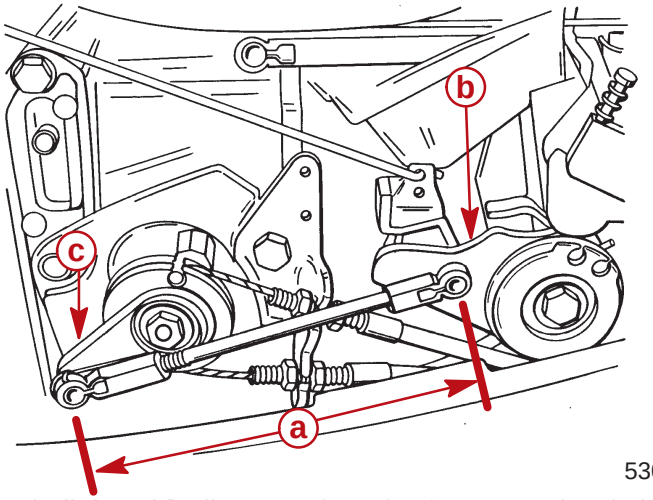
53162



53225

a - Throttle cam
b - Control lever
c - Flat washer
d - Bolt [Torque bolt to 7.9 Nm (70 lb. in.)]
e - Timing link
f - Control lever

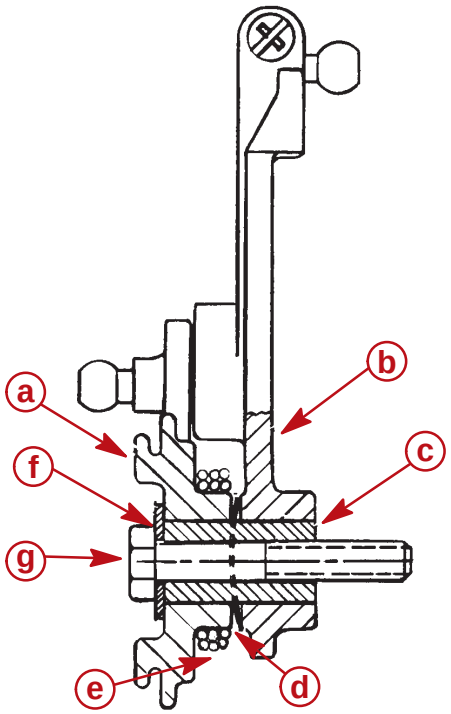
3. Adjust throttle link rod to a length of 12.4 cm (4-7/8 in.) as measured between ball joint center lines.
4. Connect throttle link rod between ball joints of throttle cam and primary throttle lever.



53046

a - Throttle link rod [Adjust to a length of 12.4 cm (4-7/8 in.)]
b - Throttle cam
c - Primary throttle lever

THROTTLE CAM/CONTROL LEVER CROSS SECTIONAL VIEW

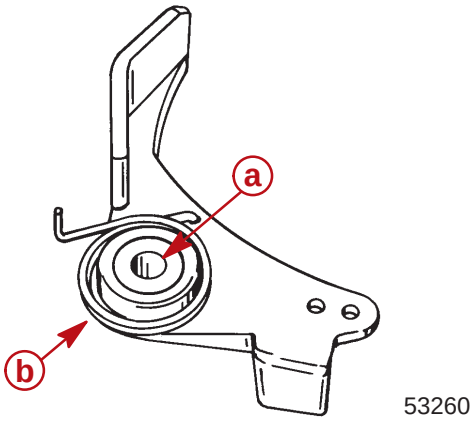


a - Throttle cam
b - Control lever
c - Bushing
d - Wave washer
e - Springs
f - Flat washer
g - Bolt [Torque to 7.9 Nm (70 lb. in.)]

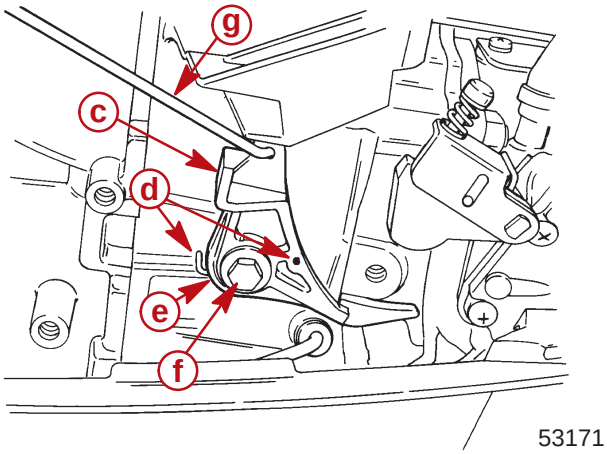
Neutral Interlock Control Lever

Reassembly/Installation

1. Lubricate bushing with 2-4-C with Teflon and install bushing and spring.
2. Secure interlock lever components with bolt onto mounting boss of crankcase cover.



53260



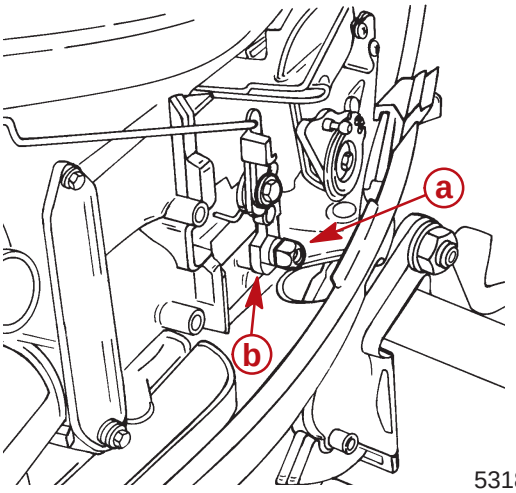
53171

a - Bushing
b - Spring
c - Interlock lever
d - Spring ends
e - Flat washer
f - Bolt [Torque to 7.9 Nm (70 lb. in.)]
g - Neutral interlock wire (install in top hole)

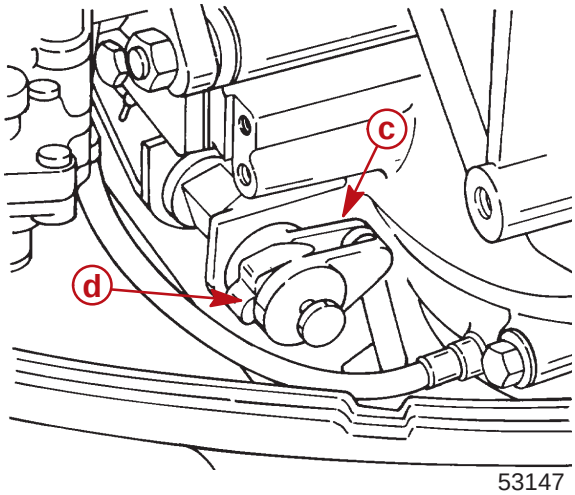
Horizontal Shift Shaft

Reassembly/Installation

1. Install horizontal shift shaft/shift lever assembly into opening in STARBOARD side of crankcase cover.
2. Apply 2-4-C with Teflon to detent of yoke and install yoke onto shift shaft.



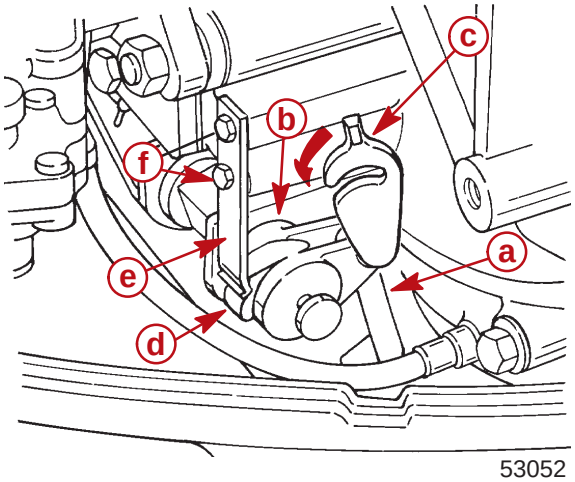
53187



53147

a - Horizontal shift shaft
b - Shift lever
c - Yoke
d - Detent

3. Secure detent spring to block with 2 bolts. Spring may have slotted holes. Install spring so that it is raised UP and at end of slot travel. Torque bolts to 2.8 Nm (25 lb. in.).
4. Secure end of shift shaft to yoke of horizontal shift shaft with lever.



53052

a - Shift shaft
b - Yoke
c - Lever
d - Apply 2-4-C with Teflon
e - Detent spring
f - Bolts [Torque to 2.8 Nm (25 lb. in)]

5. Refer to **Control Platform/Throttle Cam/Control Lever** previous and reinstall platform, shift link and throttle cam.

ATTACHMENTS/CONTROL LINKAGE

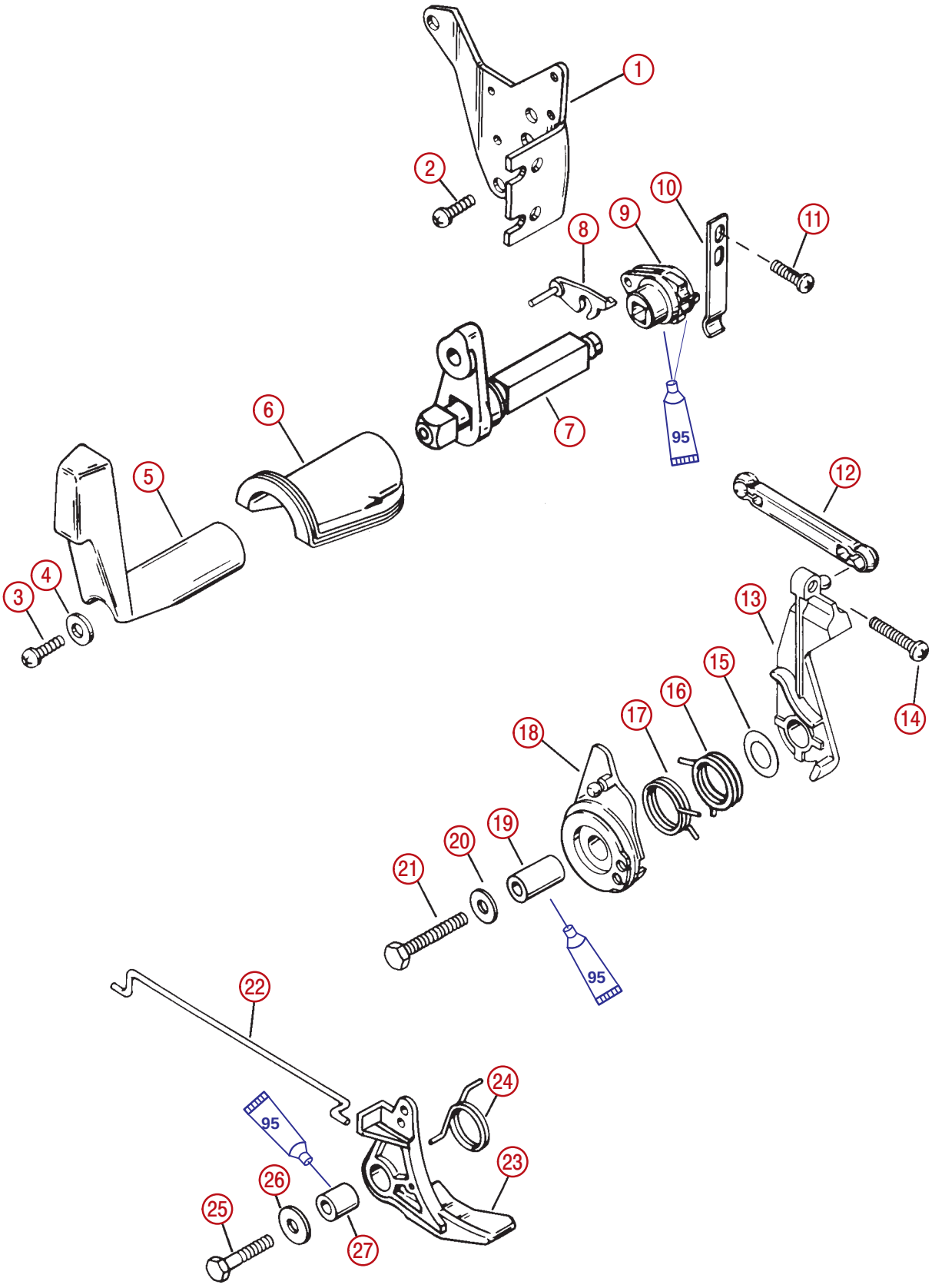
Section 7B – Throttle Shift Linkage (Side Shift Models)

Table of Contents

Throttle and Shift Linkage (Side Shift) 7B-2
Throttle Cables (Side Shift Models) 7B-4
Removal/Installation 7B-4
Throttle Cam/Control Lever 7B-4
Removal 7B-4
Reassembly 7B-4
Installation 7B-6
Neutral Interlock Control Lever 7B-8
Reassembly/Installation 7B-8
Horizontal Shift Shaft 7B-8
Reassembly/Installation 7B-8

7
B

Throttle and Shift Linkage (Side Shift)



95 2-4-C with Teflon

Throttle and Shift Linkage (Side Shift) (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CABLE BRACKET			
2	2	SCREW	60		6.8
3	1	SCREW	35		4.0
4	1	WASHER			
5	1	SHIFT HANDLE			
6	1	GROMMET			
7	1	SHIFT SHAFT			
8	1	LEVER			
9	1	LEVER			
10	1	SPRING			
11	2	SCREW (M5 x 8 x 8)	25		2.8
12	1	TIMING LINK			
13	1	CONTROL LEVER			
14	1	SCREW (M5 x 8 x 35)			
15	1	LOCKWASHER			
16	1	SPRING			
17	1	SPRING			
18	1	ACTUATOR			
19	1	BUSHING			
20	1	WASHER			
21	1	SCREW	70		7.9
22	1	LINK			
23	1	LEVER			
24	1	SPRING			
25	1	SCREW	70		7.9
26	1	WASHER			
27	1	BUSHING			

Throttle Cables (Side Shift Models)

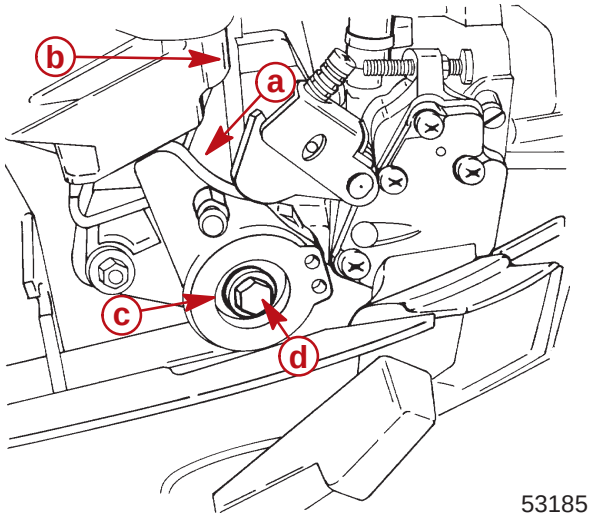
Removal/Installation

Refer to **Section 7C** for removal and installation instructions.

Throttle Cam/Control Lever

Removal

1. Refer to **Section 7C** for removal of throttle cables.
2. Remove bolt and flat washer securing cam/lever to powerhead.

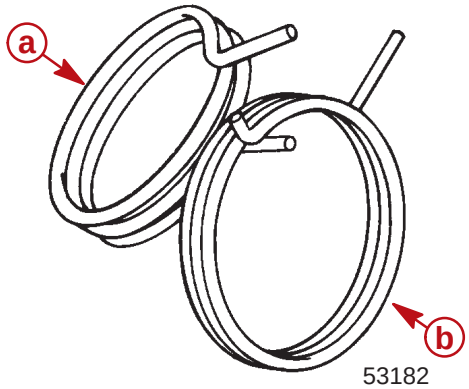


53185

a - Throttle Cam
b - Control Lever
c - Flat Washer
d - Bolt [Torque bolt to 7.9 Nm (70 lb. in.)]

Reassembly

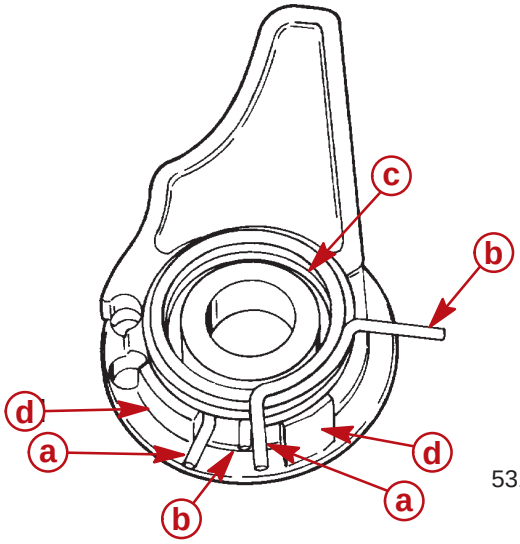
1. Assemble inner spring and outer spring together.



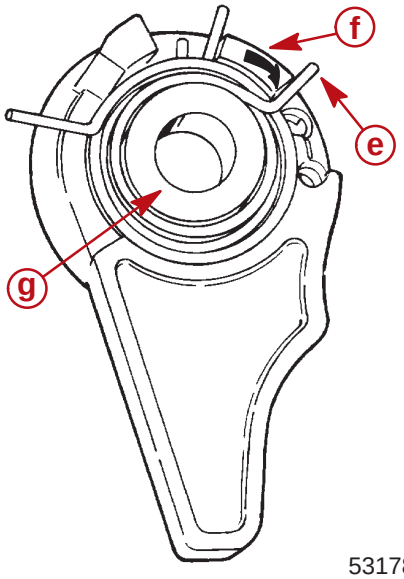
53182

a - Inner spring
b - Outer spring

2. Position spring assembly over hub of throttle cam.
3. Wind end of inner spring to position tab of cam between inner spring ends. Verify spring windings are firmly held around diameter of cam hub and that no windings are positioned on top of hub.



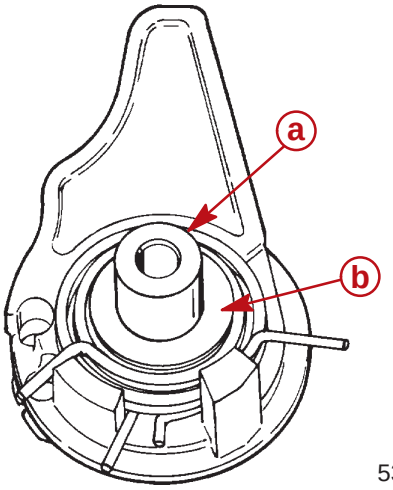
53177



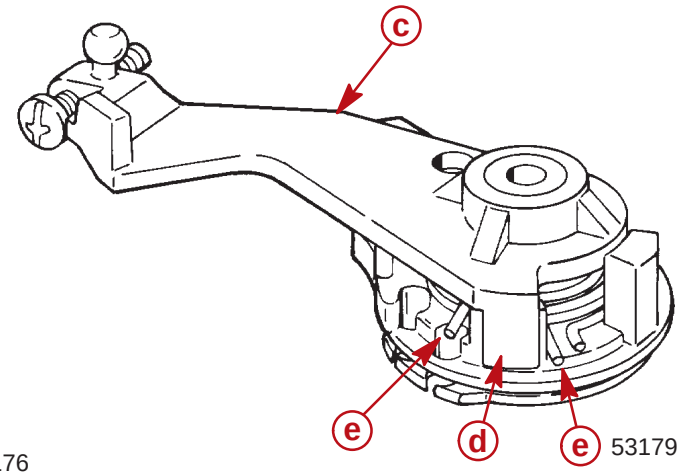
53178

a - Inner spring ends
b - Outer spring ends
c - Hub
d - Tabs
e - Inner spring end
f - Tab
g - Cam hub

4. Lubricate bushing with 2-4-C with Teflon and install bushing and wave washer.
5. Install control lever onto throttle cam assembly so that tab of control lever is positioned between ends of inner spring.



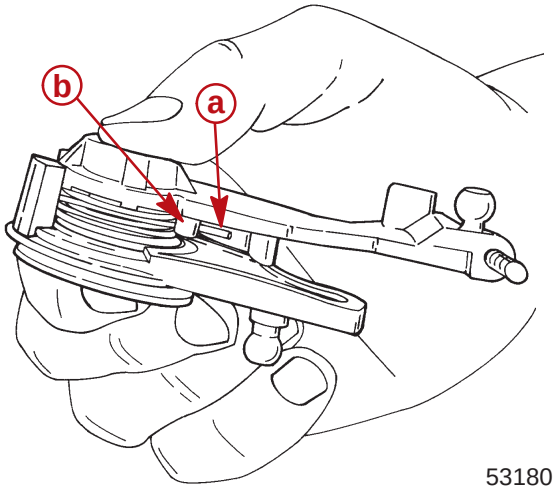
53176



53179

a - Bushing
b - Wave washer
c - Control lever
d - Tab
e - Ends of inner spring

6. Hook longer spring end of outer spring behind peg of control lever.



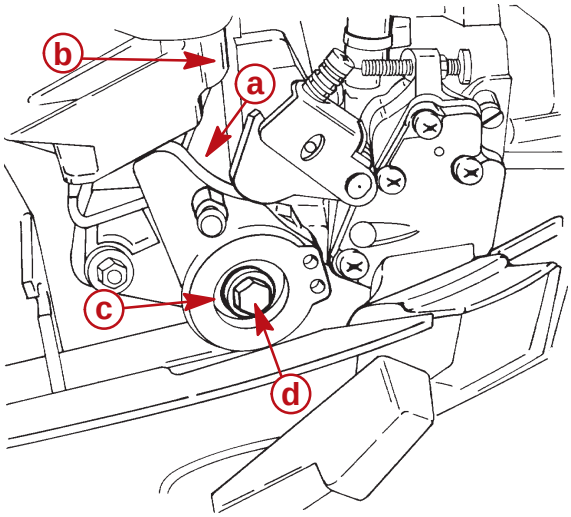
53180

a - Longer spring end
b - Peg

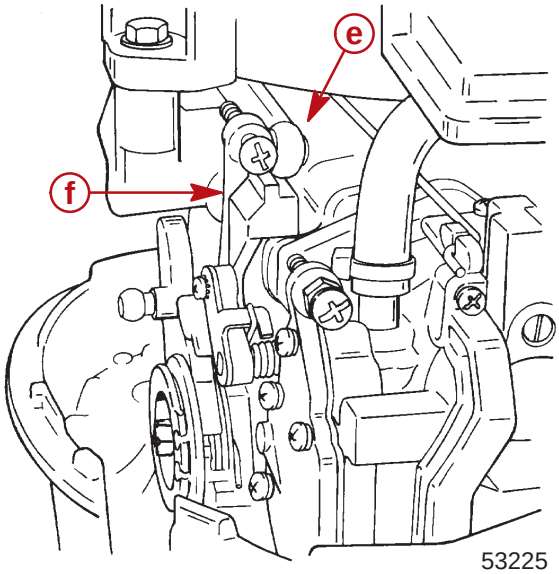
Installation

1. Secure throttle cam/control lever assembly onto mounting boss of crankcase cover with bolt. Torque bolt to 7.9 Nm (70 lb. in.).

2. Connect timing link between ball joints of control lever and trigger assembly.



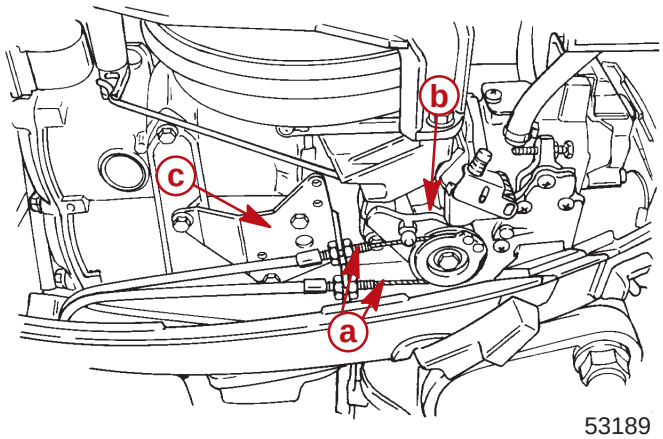
53185



53225

a - Throttle cam
b - Control lever
c - Flat washer
d - Bolt [Torque bolt to 7.9 Nm (70 lb. in.)]
e - Timing link
f - Control lever

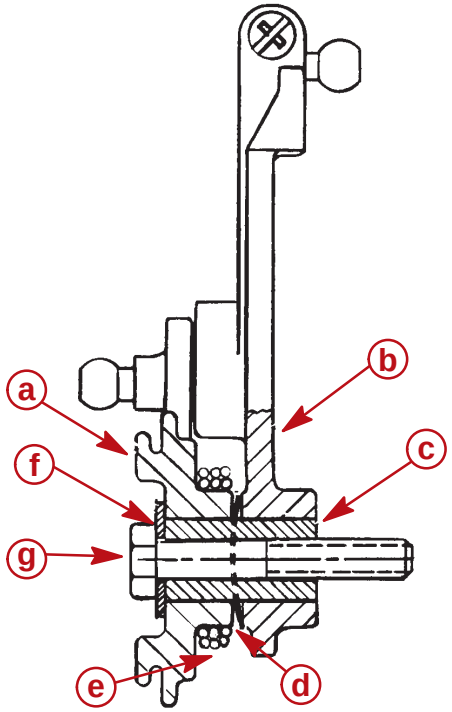
3. Connect throttle cables to throttle cam and throttle cable anchor bracket as outlined in Throttle Cable – Installation, preceding.



53189

a - Throttle cables
b - Throttle cam
c - Bracket

THROTTLE CAM/CONTROL LEVER CROSS SECTIONAL VIEW

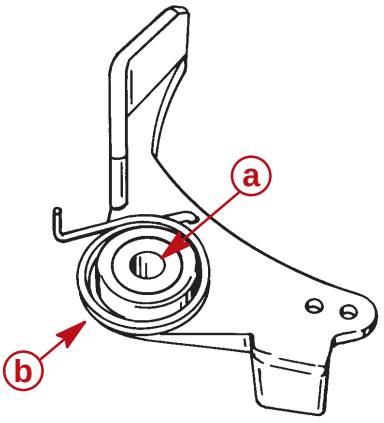


a - Throttle cam
b - Control lever
c - Bushing
d - Wave washer
e - Springs
f - Flat washer
g - Bolt [Torque to 7.9 Nm (70 lb. in.)]

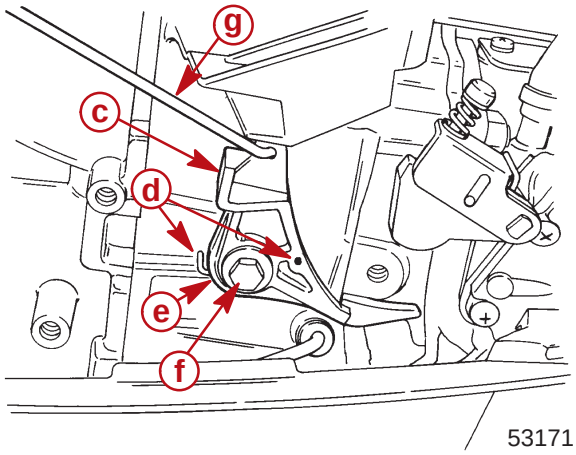
Neutral Interlock Control Lever

Reassembly/Installation

1. Lubricate bushing with 2-4-C with Teflon and install bushing and spring.
2. Secure interlock lever components with bolt onto mounting boss of crankcase cover.



53260



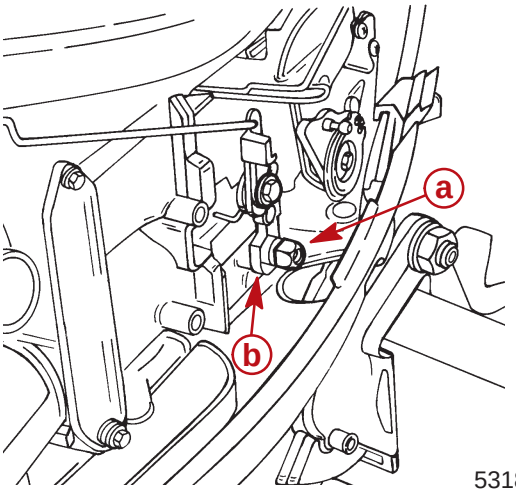
53171

a - Bushing
b - Spring
c - Interlock lever
d - Spring ends
e - Flat washer
f - Bolt [Torque to 7.9 Nm (70 lb. in.)]
g - Neutral interlock wire (install in top hole)

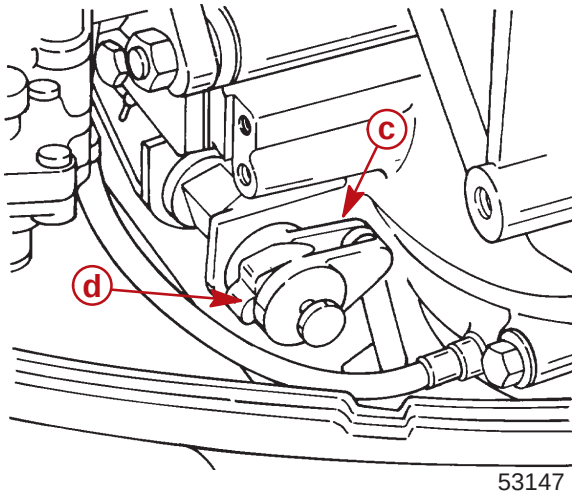
Horizontal Shift Shaft

Reassembly/Installation

1. Install horizontal shift shaft/shift lever assembly into opening in STARBOARD side of crankcase cover.
2. Apply 2-4-C with Teflon to detent of yoke and install yoke onto shift shaft.



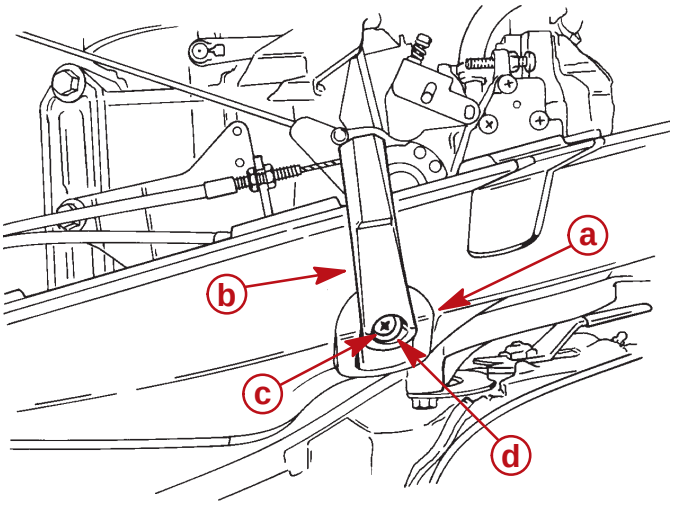
53187



53147

a - Horizontal shift shaft
b - Shift lever
c - Yoke
d - Detent

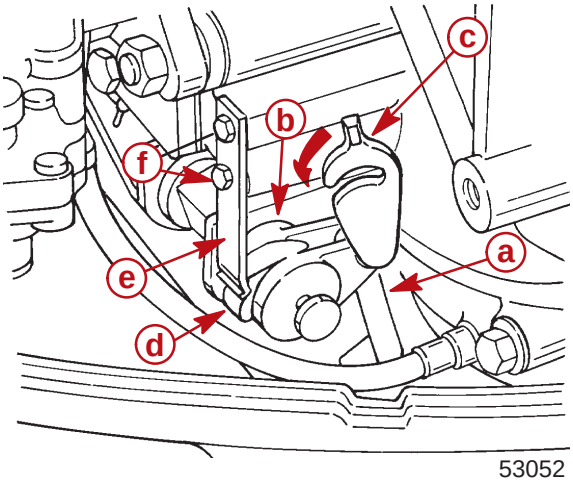
3. Install rubber grommet into opening in starboard side of bottom cowl.
4. Secure shift handle onto end of horizontal shift shaft with screw and flat washer. Torque screw to 4.0 Nm (35 lb. in.).



53181

a - Grommet
b - Shift handle
c - Screw
d - Washer

5. Secure detent spring to block with 2 bolts. Spring may have slotted holes. Install spring so that it is raised UP and at end of slot travel. Torque bolts to 2.8 Nm (25 lb. in.).
6. Secure end of shift shaft to yoke of horizontal shift shaft with coupler.



53052

a - Shift shaft
b - Yoke
c - Coupler
d - Apply 2-4-C with Teflon
e - Detent spring
f - Bolts [Torque to 2.8 Nm (25 lb. in.)]

ATTACHMENTS/ CONTROL LINKAGE

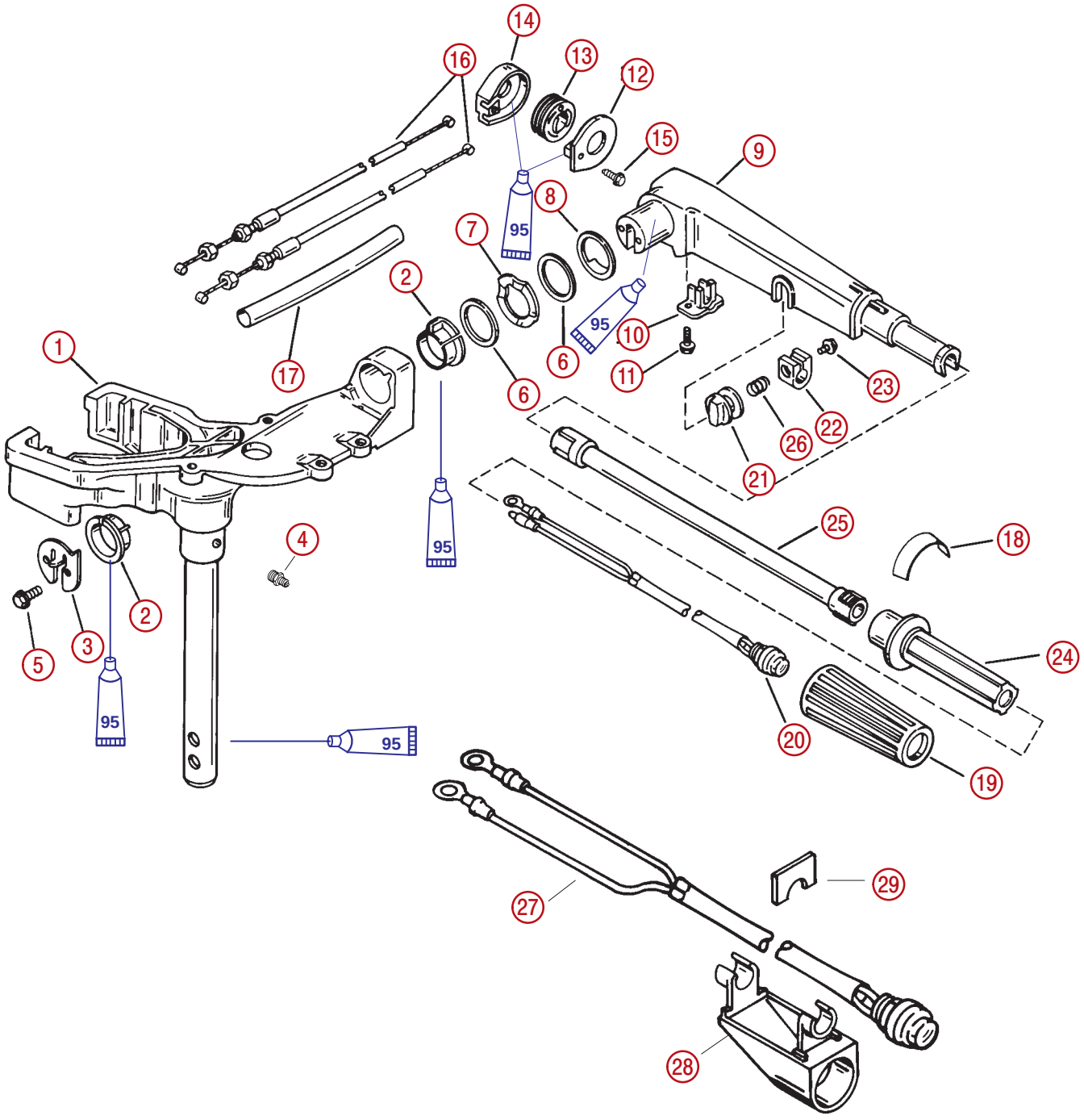
Section 7C – Tiller Handle

Table of Contents

Swivel Head and Steering Handle 7C-2
Control Cables (Tiller Handle Shift Models) . . . 7C-4
Removal 7C-4
Throttle Cables (Side Shift Models) 7C-5
Removal 7C-5
Tiller Handle Removal/Disassembly 7C-6
Removal 7C-6
Installation 7C-7
Control Cables (Tiller Handle Shift Models) . . . 7C-9
Installation 7C-9
Throttle Cable (Side Shift Models) 7C-11
Installation 7C-11

7
C

Swivel Head and Steering Handle



95 2-4-C with Teflon

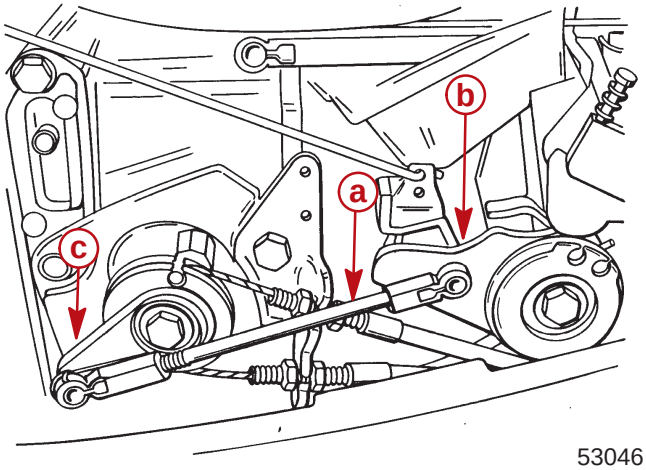
Swivel Head and Steering Handle (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	SWIVEL HEAD **(BLACK)**			
2	2	BUSHING			
3	1	PLATE			
4	1	GREASE FITTING			
5	2	SCREW (M5 x 1 x 16)	70		7.9
6	2	WASHER			
7	1	WAVE WASHER			
8	1	WASHER			
9	1	STEERING HANDLE ARM **(BLACK)**			
10	1	RETAINER			
11	1	SCREW (M5 x .8 x 16)	35		4.0
12	1	COVER KIT			
13	1	PULLEY			
14	1	PULLEY CASE			
15	1	SCREW (10-16 x 1/2)	20		2.3
16	2	THROTTLE CABLE			
17	1	SLEEVE			
18	1	DECAL			
19	1	GRIP			
20	1	STOP SWITCH			
21	1	THROTTLE FRICTION KNOB	Finger Tight		
22	1	THROTTLE FRICTION LOCK	As Required		
23	1	SCREW (M6 x 1 x 25)			
24	1	THROTTLE HANDLE			
25	1	TILLER TUBE			
26	1	SPRING			
27	1	START/STOP SWITCH			
28	1	HOUSING **ELECTRIC HANDLE**			
29	1	CLIP			

Control Cables (Tiller Handle Shift Models)

Removal

1. Place tiller handle twist grip in NEUTRAL position.
2. Remove throttle link rod from throttle cam and primary throttle lever.



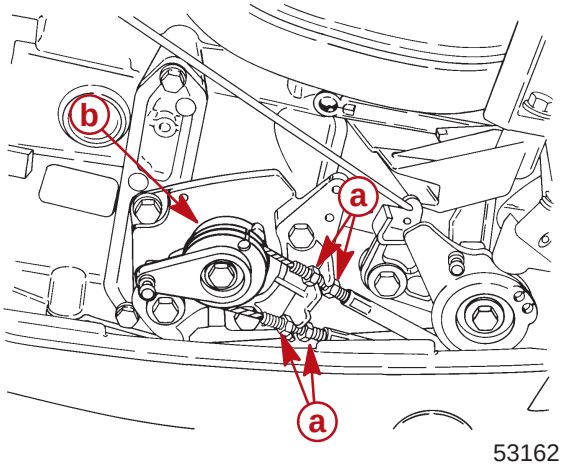
53046

a - Link rod
b - Throttle cam
c - Primary throttle lever

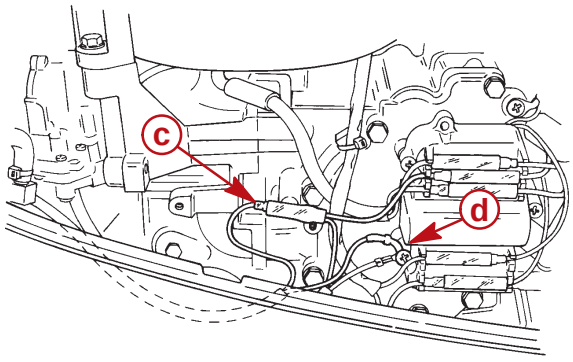
3. Loosen jam nuts which secure control cables to anchor bracket.
4. Unwrap and remove control cables from pulley of secondary gear.

NOTE: *If not replacing control cables, mark top cable with a piece of tape to aid in reassembly.*

5. Disconnect stop button wires – BLACK/YELLOW and BLACK.



53162



53157

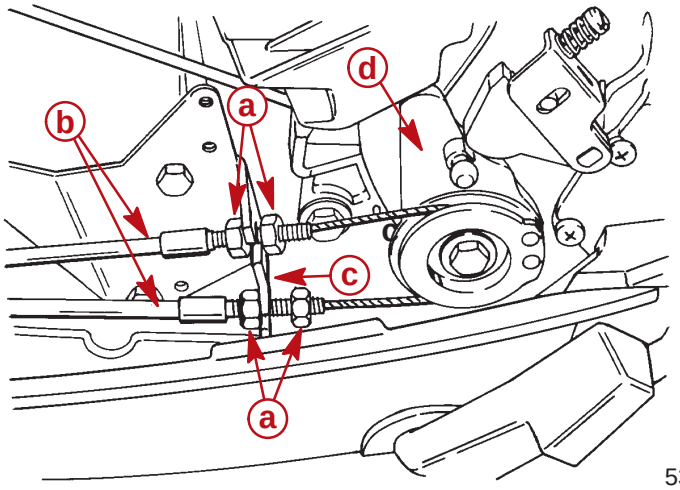
a - Jam nuts
b - Secondary gear
c - BLACK/YELLOW
d - BLACK

Throttle Cables (Side Shift Models)

Removal

1. Loosen jam nuts which secure throttle cables to anchor bracket and remove cables from pulley of throttle cam.

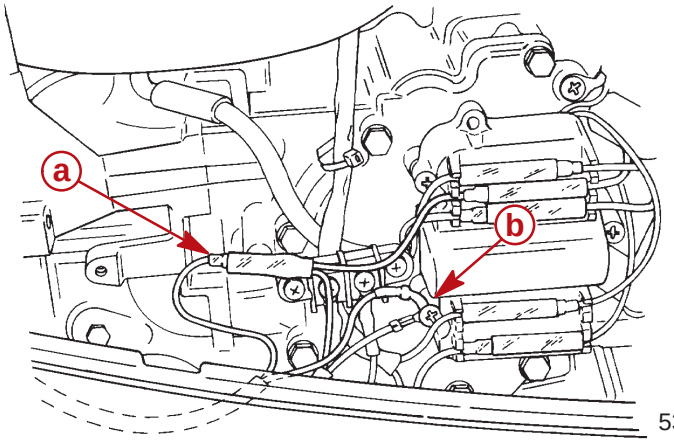
NOTE: *If not replacing throttle cables, mark top cable with a piece of tape to aid in reassembly.*



53186

a - Jam nuts
b - Throttle cables
c - Anchor bracket
d - Throttle cam

2. Disconnect stop button wires – BLACK/YELLOW and BLACK.



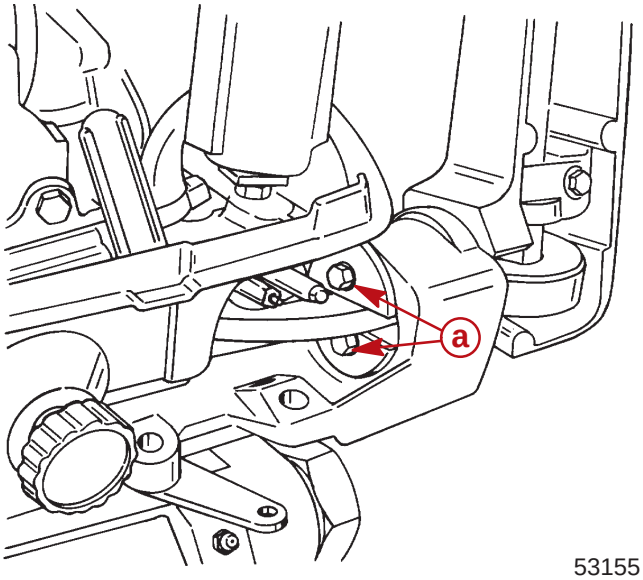
53156

a - BLACK/YELLOW
b - BLACK

Tiller Handle Removal/Disassembly

Removal

1. Remove 2 bolts securing tiller handle to anchor bracket and remove tiller handle assembly.

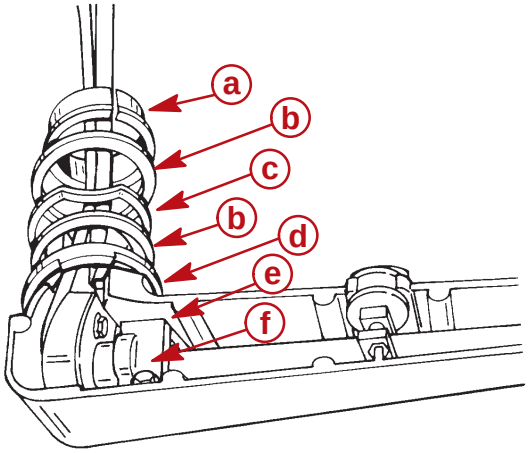


53155

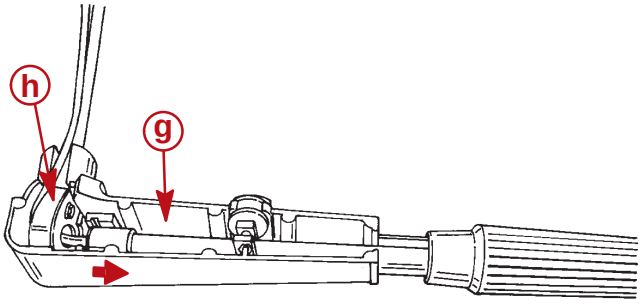
a - Bolts

2. Remove bushing, flatwashers (2), wave washer and tiller handle washer. Remove retainer and bolt.

3. Slide tiller tube out of pulley case.



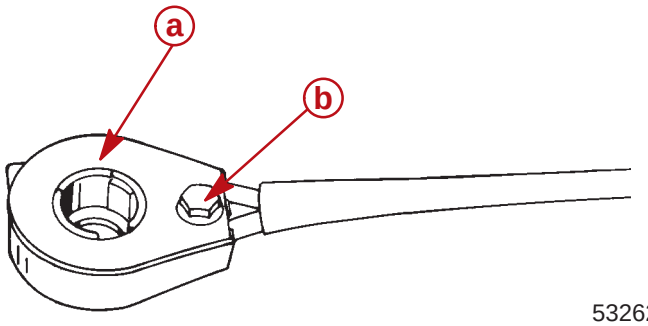
53248



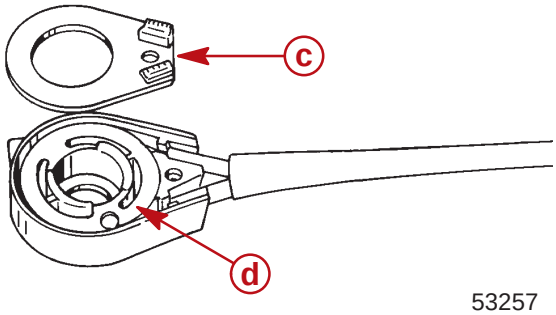
53256

a - Bushing
b - Flat washer (2)
c - Wave washer
d - Tiller handle washer
e - Retainer
f - Bolt
g - Tiller tube
h - Pulley case

4. Remove pulley case assembly from tiller handle and remove cover bolt.
5. Remove cover and lift pulley assembly from case. Replace cables as required.



53262

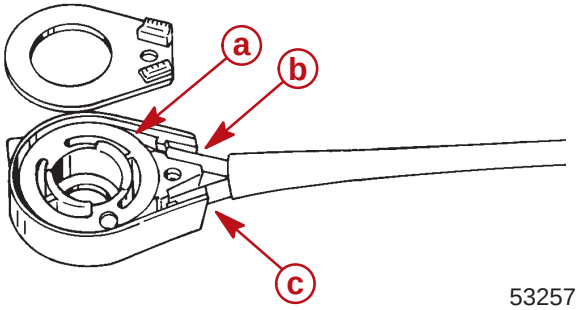


53257

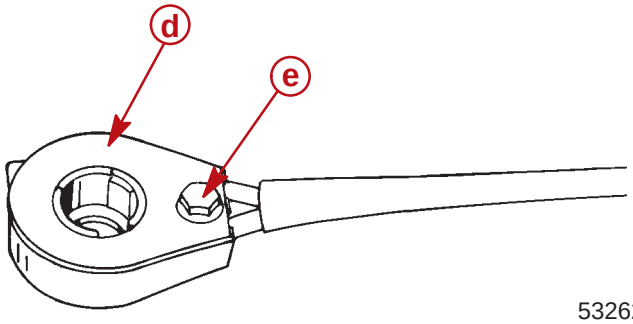
a - Pulley case assembly
b - Cover bolt
c - Cover
d - Pulley assembly

Installation

1. Wrap cables around pulley. Top cable wraps and locks in top groove. Bottom cable wraps and locks in bottom groove.
2. Place pulley and cable assembly into pulley case.
3. Install pulley cover and secure cover with bolt. Torque bolt to 2.3 Nm (20 lb. in.).



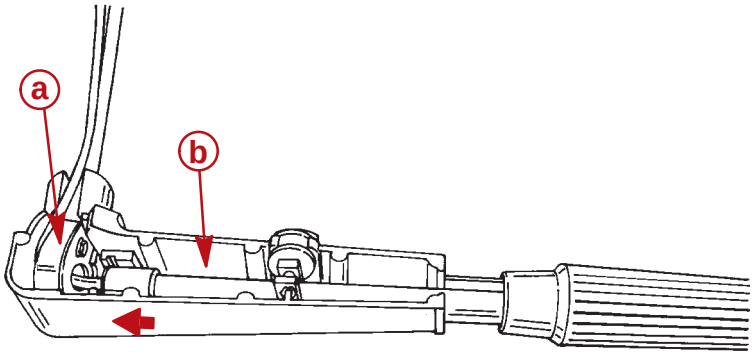
53257



53262

a - Pulley
b - Top cable
c - Bottom cable
d - Cover
e - Bolt [Torque to 2.3 Nm (20 lb. in.)]

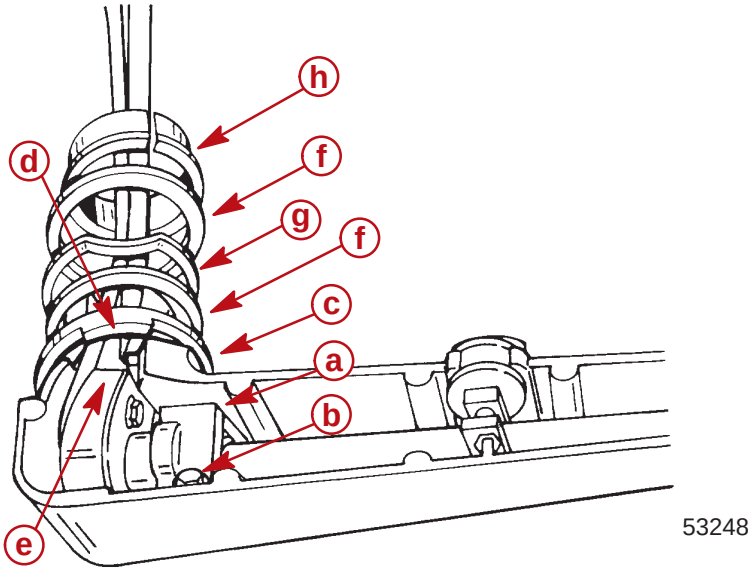
4. Install pulley assembly into tiller handle and slide tiller tube into pulley.



53256

a - Pulley assembly
b - Tiller tube

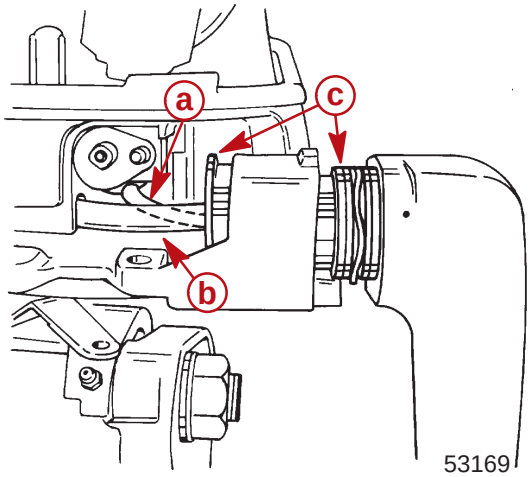
5. Secure tiller tube in handle with retainer and bolt. Torque bolt to 4.0 Nm (35 lb. in.).
6. Install tiller washer (tab aligns with slot in handle), plain washer, wave washer, plain washer and flanged bushing over cable/harness assembly.



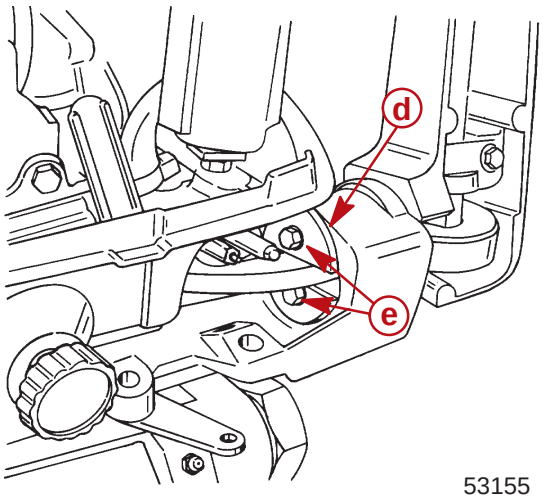
53248

a - Retainer
b - Bolt [Torque to 4.0 Nm (35 lb. in.)]
c - Tiller washer
d - Tab
e - Slot
f - Plain washer
g - Wave washer
h - Flanged bushing

7. Slide tiller handle assembly into anchor bracket.
8. Route stop button harness through fuel connector opening in bottom cowl.
9. Route control cables through opening in bottom cowl.
10. Align tabs of inner and outer flanged bushings with slots in anchor bracket.
11. Pull on cable ends to remove slack and secure tiller handle to anchor bracket with plate and 2 bolts. Torque bolts to 7.9 Nm (70 lb. in.).



53169



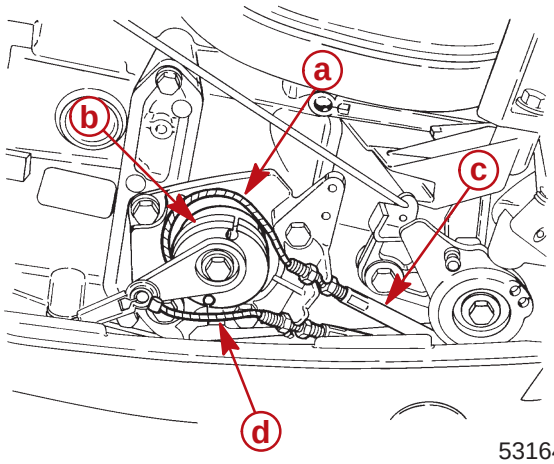
53155

a - Stop button harness
b - Control cables
c - Tabs
d - Plate
e - Bolts [Torque to 7.9 Nm (70 lb. in.)]

Control Cables (Tiller Handle Shift Models)

Installation

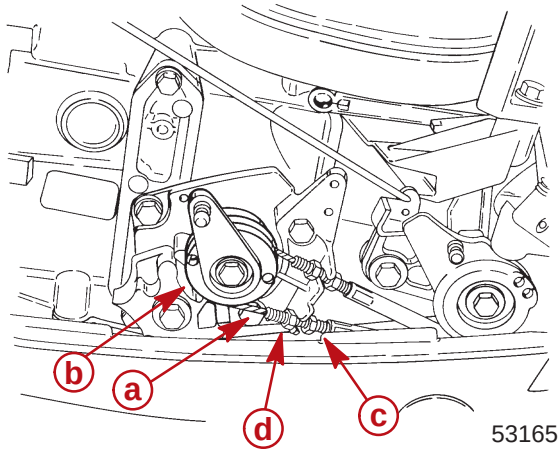
1. Rotate tiller handle twist grip to REVERSE gear position.
2. Route extended cable over top of secondary gear pulley and secure cable into inner groove of pulley. Place cable jacket into inner notch of cable anchor bracket.



53164

a - Extended cable
b - Inner groove
c - Cable jacket
d - Inner notch

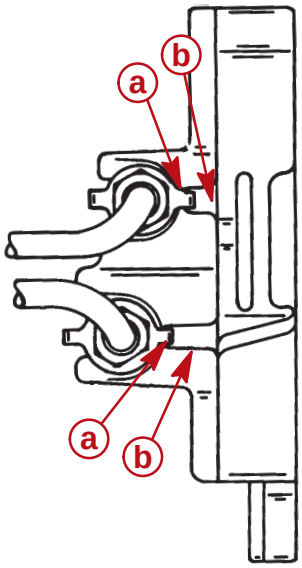
3. Rotate tiller handle to FORWARD gear position.
4. Route remaining cable below secondary gear pulley and secure cable into outer groove of pulley. Place cable jacket into lower notch of cable anchor bracket.



53165

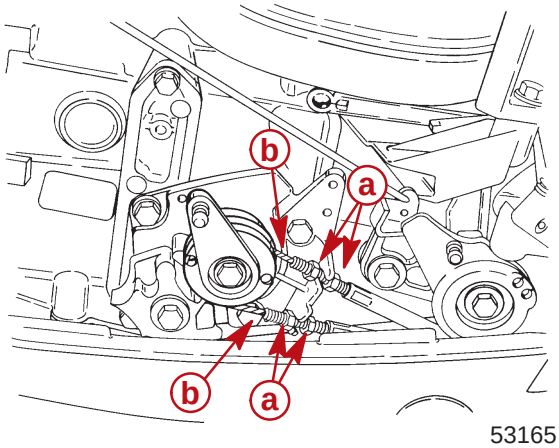
a - Cable
b - Outer groove
c - Cable jacket
d - Lower notch

5. Position tab washers to lock control cables to holes of cable anchor bracket.



a - Tab washers
b - Hole

6. Rotate tiller handle twist grip to NEUTRAL.
7. Adjust jam nuts to remove slack from control cables while allowing full travel of throttle/shift linkage.



53165

a - Jam nuts
b - Cables

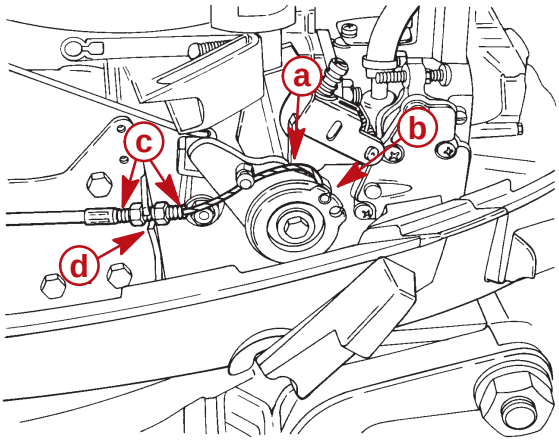
8. After cables are adjusted, verify FORWARD, NEUTRAL and REVERSE gears can be selected while smoothly advancing and retarding throttle. If throttle/shift operation is not correct, inspect for pinched or kinked cables, misaligned linkage or loose attaching bolts.

NOTE: *It may be necessary to rotate propeller shaft in order to select REVERSE gear.*

Throttle Cable (Side Shift Models)

Installation

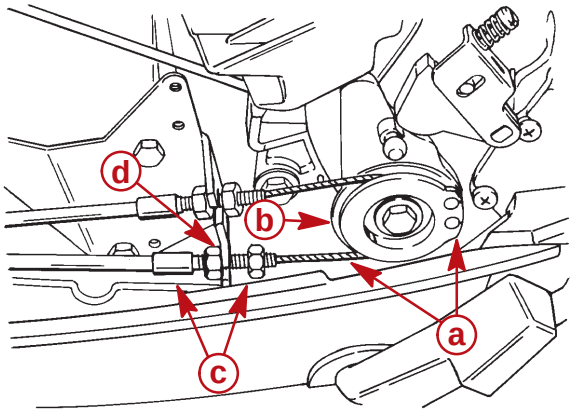
1. Rotate tiller handle twist grip to FAST position.
2. Place gear shift lever into FORWARD gear.
3. Secure extended cable into groove in top side of throttle cam pulley. Place cable jacket into upper notch of cable anchor bracket.



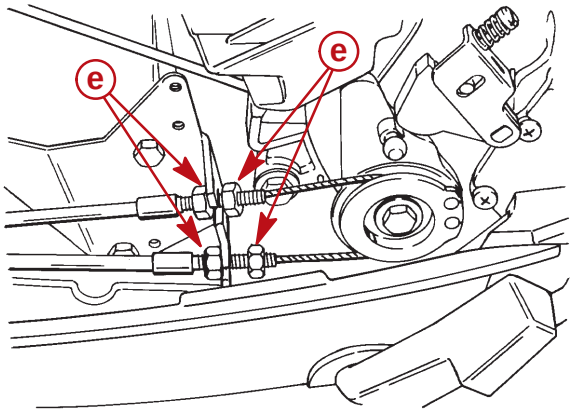
53190

a - Extended cable
b - Pulley
c - Cable jacket
d - Notch

4. Rotate tiller handle twist grip to SLOW position.
5. Secure remaining cable into groove in bottom side of pulley. Place cable jacket into lower notch of anchor bracket.
6. Secure throttle cables into notches of cable anchor bracket.
7. Rotate tiller handle twist grip to SLOW position.
8. Adjust jam nuts to remove slack from throttle cables while allowing full travel of throttle linkage/carburetor throttle shutter.



53186



53186

a - Cable
b - Pulley
c - Cable jacket
d - Notch
e - Jam nuts

MANUAL STARTER

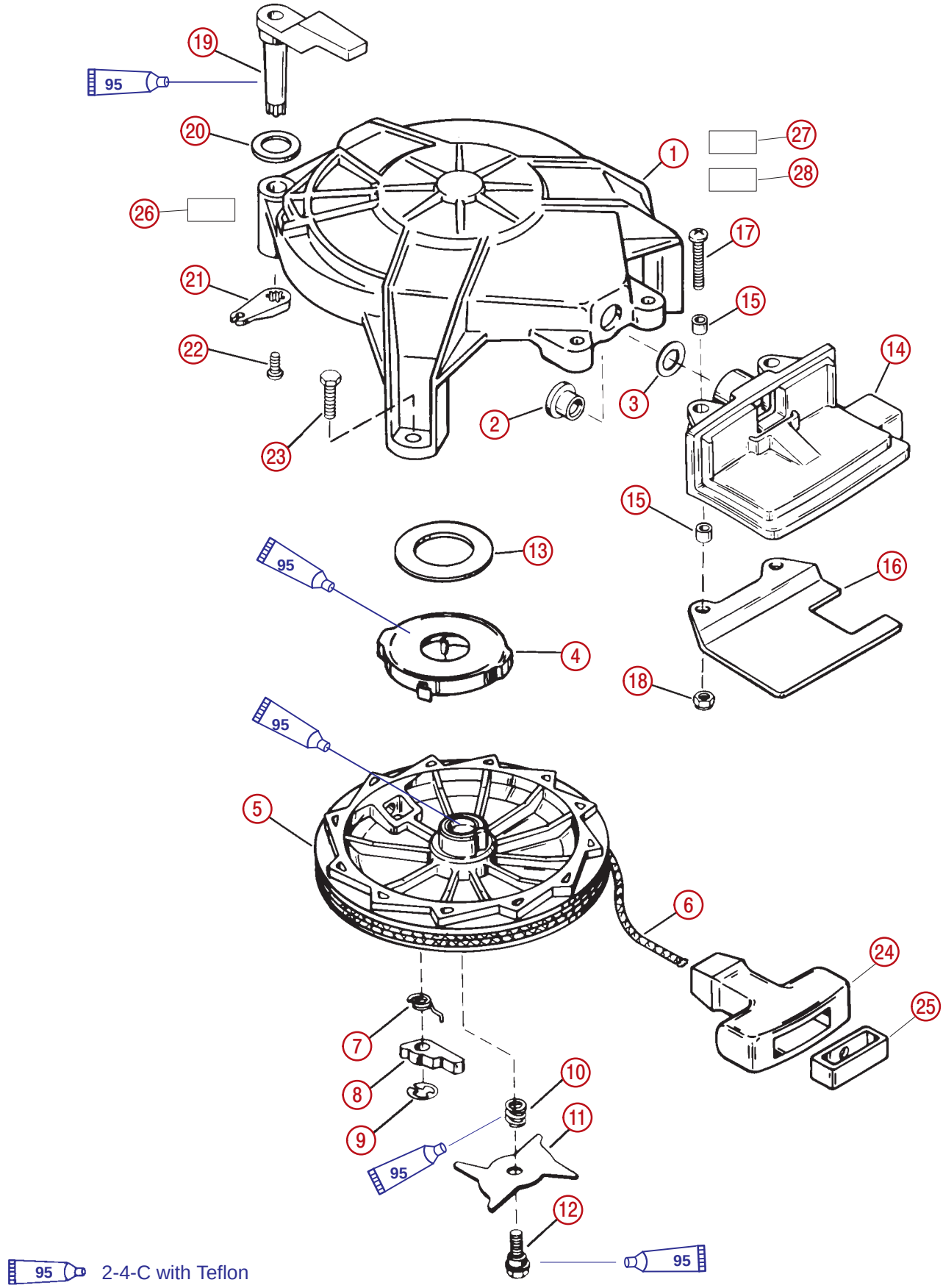
Section 8

Table of Contents

Manual Starter 8-2
Rewind Starter Assembly 8-4
Removal 8-4
Installation 8-5
Starter Rope Replacement 8-6
Disassembly 8-8
Cleaning and Inspection 8-9
Reassembly 8-9

8

Manual Starter



Manual Starter (continued)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
–	1	RECOIL STARTER ASSEMBLY			
1	1	STARTER HOUSING			
2	1	BUSHING			
3	1	RETAINING RING			
4	1	SPRING			
5	1	STARTER PULLEY			
6	1	ROPE–starter			
7	2	SPRING			
8	2	CAM			
9	2	RETAINING RING			
10	1	SPRING			
11	1	CAM			
12	1	SCREW	135		15.3
13	1	FELT PAD			
14	1	REST			
15	4	SPACER–rest screw			
16	1	SUPPORT			
17	2	SCREW–rest to starter housing (M5 x 35)			
18	2	NUT–rest screw	30		3.4
19	1	LEVER–lock **(UPPER)**			
20	1	WASHER–upper lock lever			
21	1	LEVER–lock **(LOWER)**			
22	1	SCREW–lower lock lever (10-16 x 1/2)	30		3.4
23	3	SCREW–starter housing attaching (M6 x 20)	70		7.9
24	1	HANDLE ASSEMBLY			
25	1	RETAINER			
26	1	DECAL-Servicing Referral			
27	1	DECAL-Warning-High Voltage			
28	1	DECAL-Emergency Starting Procedure			

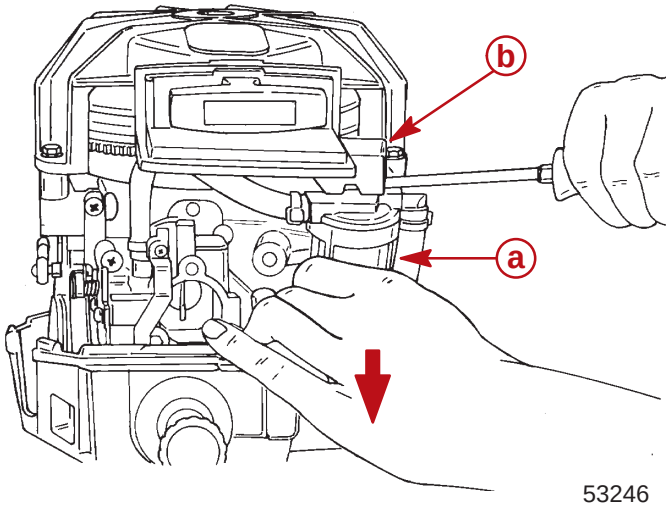
Rewind Starter Assembly

Removal

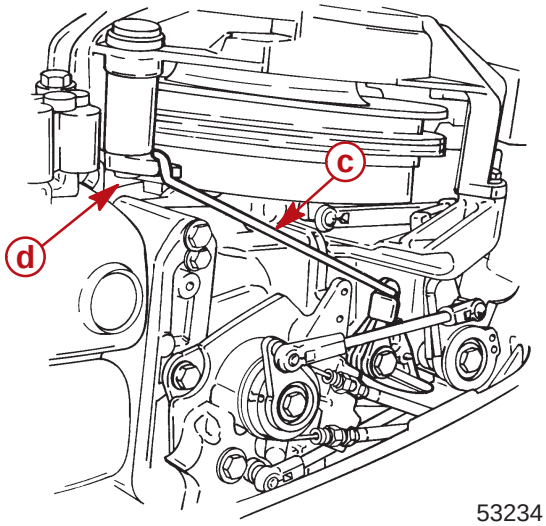
⚠ CAUTION

DO NOT turn fuel filter assembly when removing. Remove fuel filter by pulling straight down. Turning fuel filter may break fuel line connection on filter.

1. Pry fuel filter from starter rope guide. DO NOT turn filter; pull straight down.
2. Unsnap interlock link rod from lower lock lever.



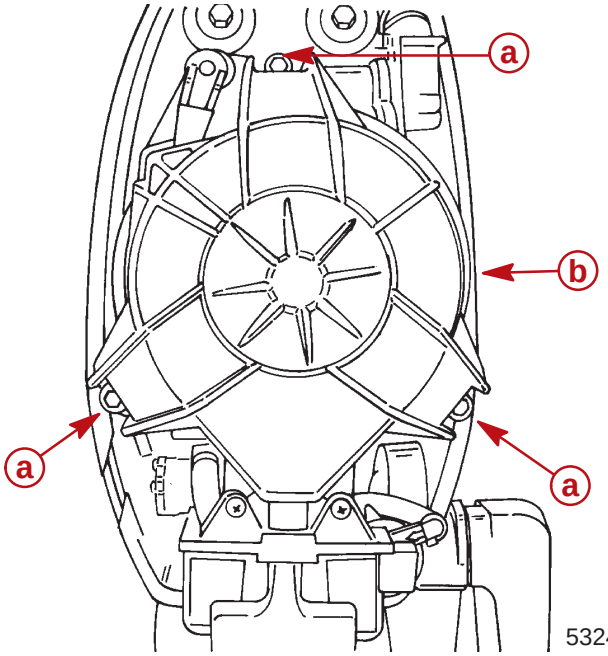
53246



53234

a - Filter
b - Guide
c - Link rod
d - Lock lever

3. Remove 3 bolts and lift rewind starter from engine.

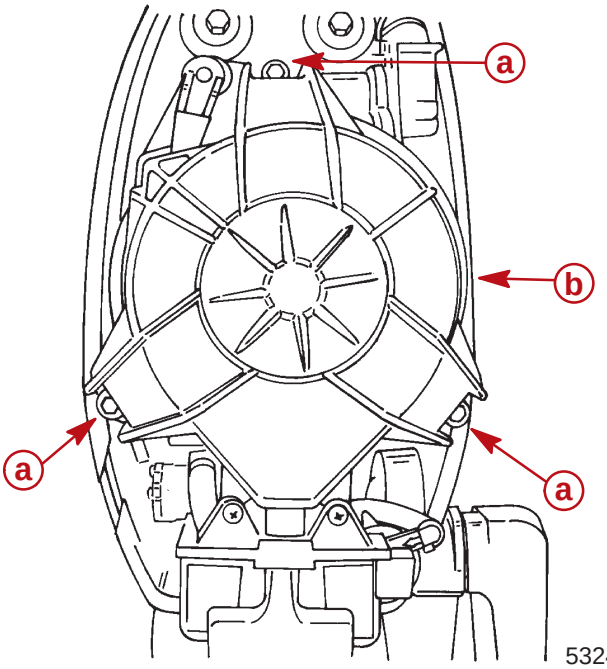


53242

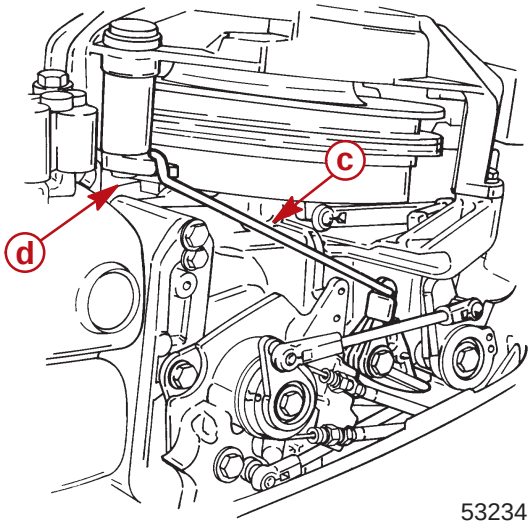
a - Bolts
b - Rewind starter

Installation

1. Secure rewind starter to engine with 3 bolts. Torque bolts to 7.9 Nm (70 lb. in.).
2. Snap interlock link rod into lower lock lever.



53242



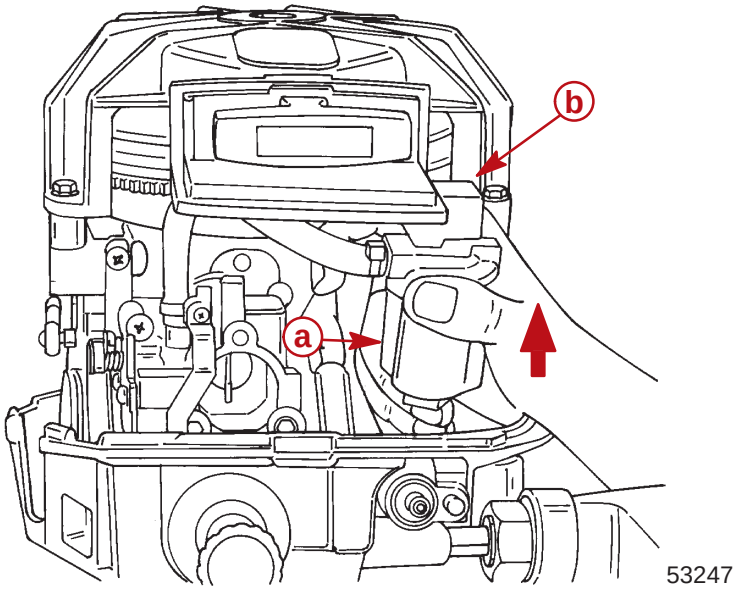
53234

a - Bolts [Torque to 7.9 Nm (70 lb. in.)]
b - Rewind starter
c - Link rod
d - Lock lever

⚠ CAUTION

Push filter straight up when installing. Turning filter may break fuel line connection on filter.

3. Push ball of fuel filter into socket of rope guide. DO NOT turn fuel filter.



53247

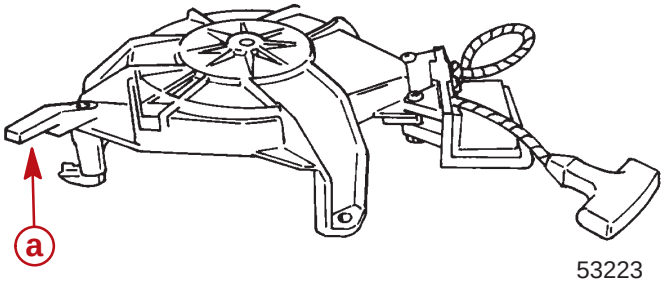
a - Filter
b - Guide

Starter Rope Replacement

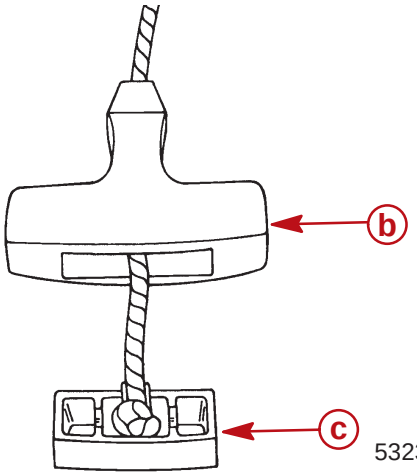
1. Remove rewind starter from engine, as outlined previously.

NOTE: *If starter is broken, remove all remaining rope from sheave.*

2. Disengage starter interlock from starter sheave.
3. Pull starter rope handle out from rewind starter about 30.5 cm (1 ft.) and tie a knot at this point to prevent rope from being pulled back into rewind starter.
4. Remove rope retainer from starter handle and rope.



53223



53233

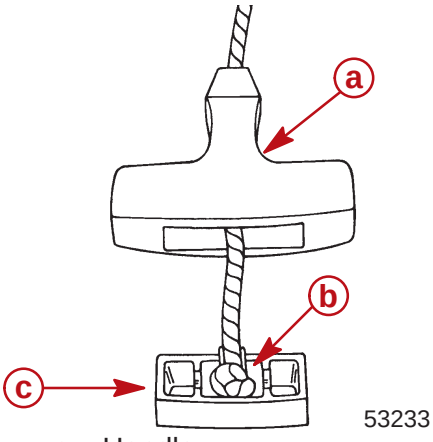
a - Interlock
b - Starter handle
c - Retainer

5. Install starter handle on new rope [cut to a length of 157.5 cm (62 in.)]. Tie a knot into end of rope. Place knot into recess of rope retainer. Install rope retainer into starter handle.

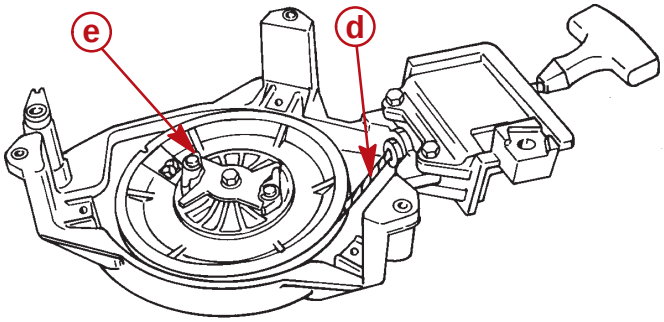
⚠ CAUTION

Starter sheave must be firmly held against spring tension to prevent spring from unwinding.

6. Pull starter rope from rewind starter until rope is fully unwound from starter sheave.



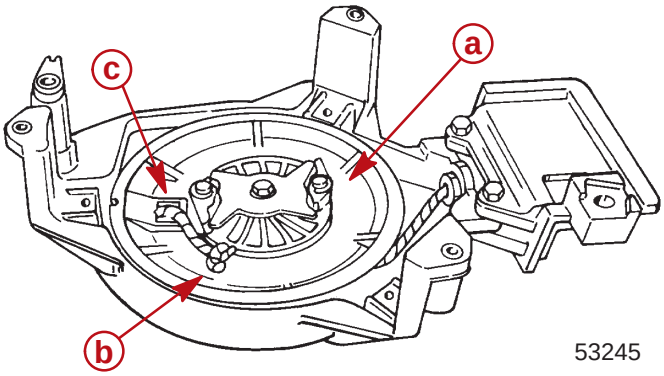
53233



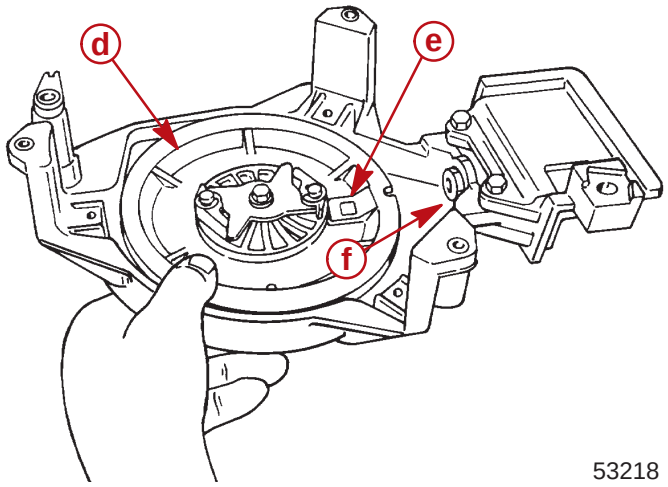
53221

a - Handle
b - Knot
c - Retainer
d - Rope
e - Sheave

7. While holding sheave in this position, lift knot from recess and pull all remaining rope from sheave.
8. Turn sheave COUNTERCLOCKWISE until stop, indicating spring is wound tight.
9. Slowly turn sheave CLOCKWISE (with spring tension) until knot recess is aligned with rope hole in starter housing.



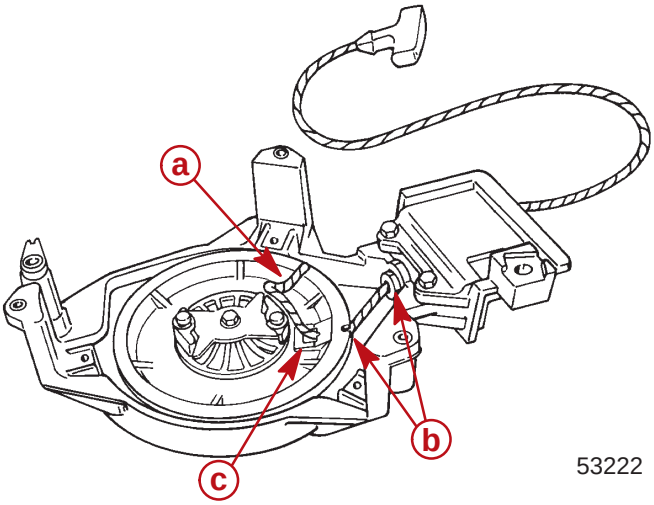
53245



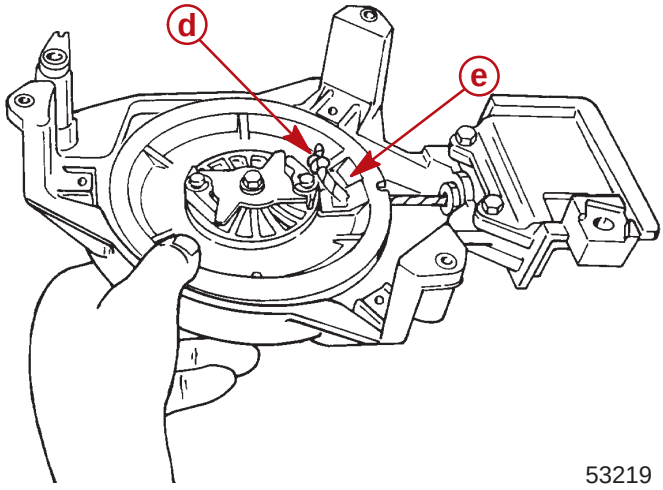
53218

a - Sheave
b - Knot
c - Recess
d - Sheave
e - Knot recess
f - Rope hole

10. Push end of new rope through rope holes in starter housing and starter sheave. Pull end of rope out of knot recess.
11. Tie a knot into end of rope and pull knot back into knot recess.



53222



53219

a - Rope
b - Holes
c - Knot recess
d - Knot
e - Knot recess

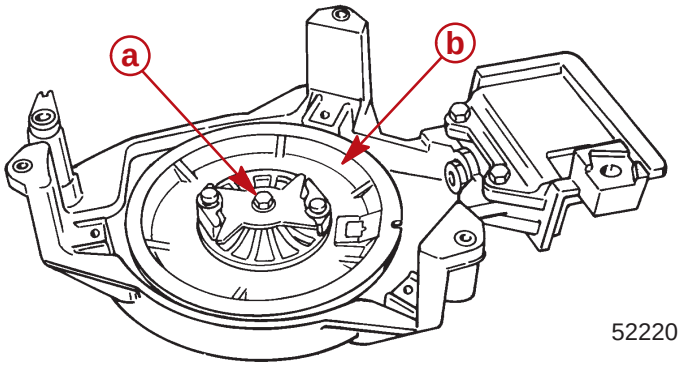
12. Allow starter rope to be slowly rewound onto starter sheave.

Disassembly

⚠ WARNING

When disassembling rewind starter, SAFETY GLASSES MUST BE WORN in case spring should uncoil out of housing.

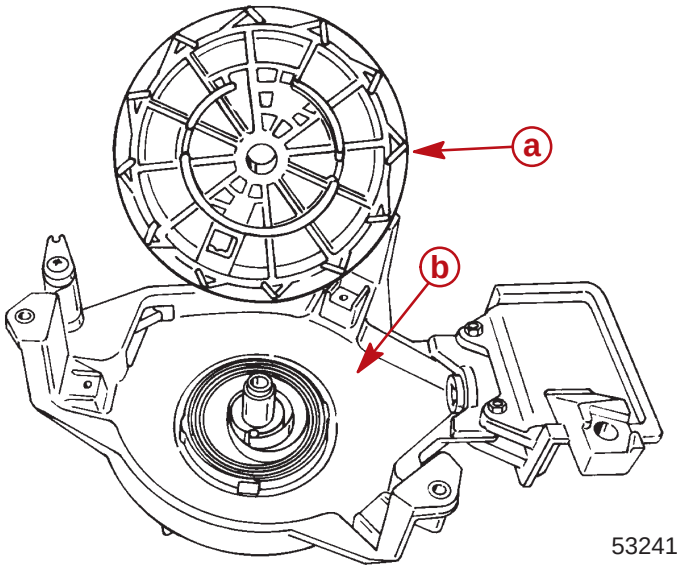
1. Remove starter rope as outlined previously.
2. With rope removed, allow sheave to slowly unwind to release spring tension.
3. Remove bolt securing cam and sheave to housing.



52220

a - Bolt
b - Sheave

4. Gently lift starter sheave from housing.
5. Rewind spring assembly may be replaced as required. DO NOT remove spring from retainer. Spring and retainer are replaced as an assembly.



53241

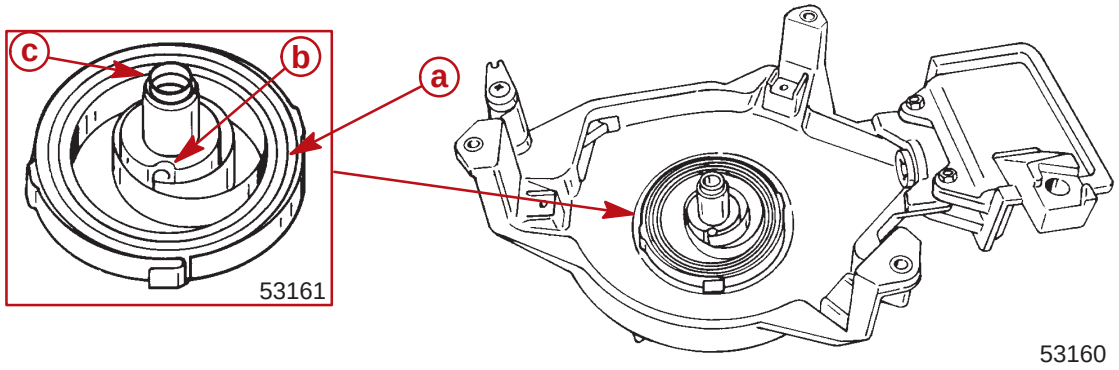
a - Sheave
b - Rewind spring

Cleaning and Inspection

1. Clean rewind spring assembly with solvent and dry with compressed air.
2. Inspect rewind spring (without removing spring from retainer) for kinks, burrs or breakage. Replace assembly if necessary.
3. Inspect cam tension spring for damage. Replace as necessary.
4. Inspect starter sheave and housing for nicks, grooves, cracks and distortion especially in area of rope travel. Replace assembly if necessary.
5. Inspect starter rope for wear and replace if necessary.

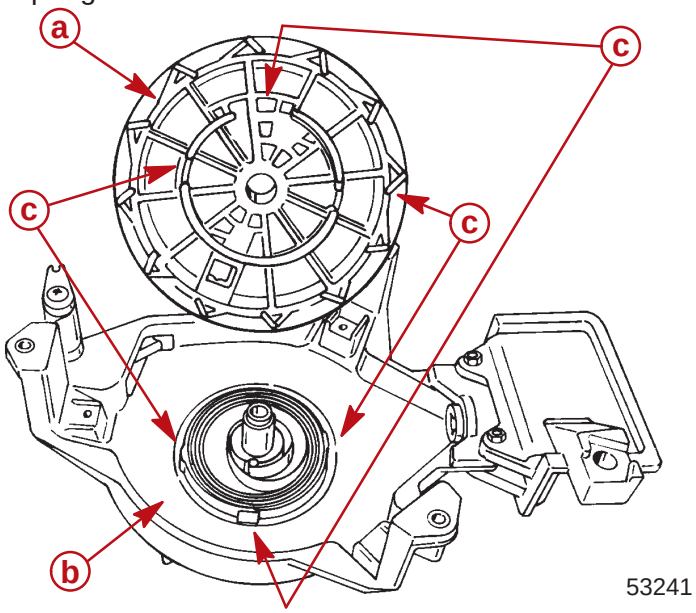
Reassembly

1. Apply 2-4-C with Teflon to rewind spring and cam tension spring.
2. Install rewind spring assembly into recoil housing positioning end of spring in notch.



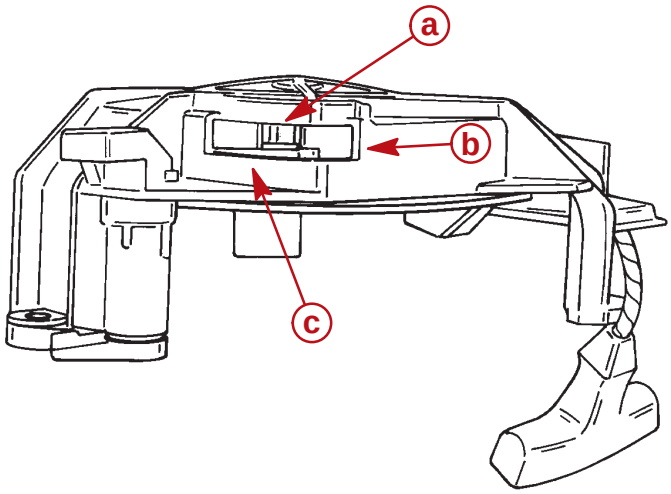
a - Rewind spring
b - Notch
c - Cam tension spring

3. Install starter sheave into housing aligning notches in sheave with appropriate locations on recoil spring retainer.



a - Sheave
b - Retainer
c - Alignment notches

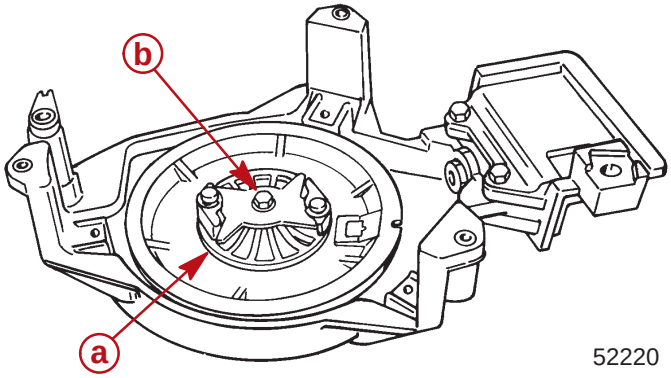
NOTE: *If sheave will not seat fully over recoil spring assembly, inspect spring retainer, through lock lever access hole in housing, for proper alignment with sheave.*



53217

a - Spring retainer
b - Lock lever access hole
c - Sheave

4. Secure cam to housing with bolt. Torque bolt to 7.9 Nm (70 lb. in.).



52220

a - Cam
b - Bolt

NOTE: *If, after tightening cam retaining bolt, sheave does not move freely, sheave is not aligned properly with recoil spring retainer. Remove cam retainer bolt and check alignment of sheave with spring retainer.*

5. Install starter rope as outlined previously.
6. Install rewind starter as outlined previously.